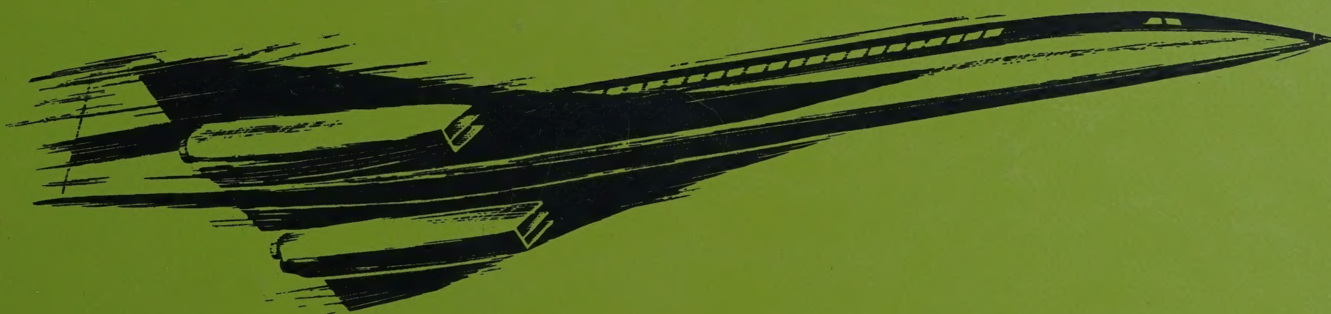
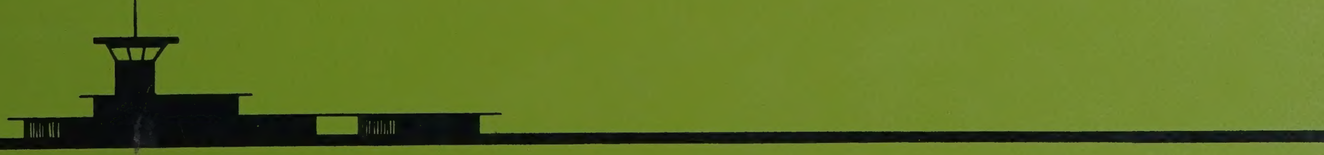
airports for export from canada

PLANNING MANUAL

First Edition

Volume I
Volume 2





airports for export from canada

planning guide

Volume 1

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PURPOSE OF PLANNING GUIDE

The "Airports for Export from Canada - Planning Guide" has been prepared as a part of the "Airports for Export" programme organized by the Canadian Department of Trade and Commerce.

This programme was launched in January 1966 to develop Canadian export potential in all areas related to the planning, design, construction and equipment of airports.

A joint Government/Industry committee known as the Airport Export Committee was formed consisting of representatives from the Department of Trade and Commerce together with Consultants, Contractors and Equipment Manufacturers. Ad hoc representation has been provided by the Department of Transport and the Department of Industry.

Publications designed to assist in export promotion have been produced as part of the work of the Committee. These have included an "Airports for Export from Canada" catalogue (2nd Edition - 1968), and a World Market Study (3rd Edition - 1968). The Planning Guide, together with its Audio-Visual Supplement, a 30-minute taped-slide presentation entitled "Canada Presents Airports for Export", was commissioned in December 1967.

The prime purpose of the Planning Guide is to assist those involved in furthering the Airport Export Programme to:

- determine the needs of a potential customer;
- show how Canada can fill those needs;
- provide guideline estimates of the cost of filling the needs.

It must be stressed, with regard to the provision of guideline estimates and the application of the various sections related to Planning and Design, that this Planning Guide is intended for use primarily by those who have been involved in the design and construction of airports. Extreme caution must be exercised in this respect, especially insofar as budget estimating is concerned.

Such costs as are included herein have been based on estimates for work executed in Canada using 1967 indices. Variables related to the particular merits of each potential export situation must be examined carefully before any serious discussion can be entered into regarding even guideline budget estimates. Where major development is being considered, the need for Master Planning must be stressed, and certainly preliminary feasibility and economic studies should be executed in all cases where requirements include major construction or equipment programmes.

Canada can provide everything (apart, presently, from portions of ILS systems) for airport development. Consultants, in conjunction with the Department of Transport, have developed a systems planning approach to Airport Master Planning which has been applied to the preparation of Twenty-Year Master Plan Reports for major Canadian airports. The implementation of these studies will result in phased incremental development programmes to provide facilities to meet the needs up to 1980.

PURPOSE OF PLANNING GUIDE

Canadian capability for the design and construction of runway/taxiway/apron systems and of facilities for passengers, cargo and other associated activities is evident in the existing airport system, which is regarded highly around the world.

The high standards of quality maintained in the design and manufacture of Canadian airport equipment has long been recognized.

The development and manufacture of aircraft, particularly those with STOL capability, has placed Canada in the position of being able to offer complete air transportation systems. Newly-emergent nations, with vast areas to be developed, are a natural market for systems utilizing such aircraft.

This first edition of the Planning Guide contains basic information which will be of use to those seeking to expand Canada's export potential.

It contains highlights of the extensive history of aviation development in Canada together with a brief description of the current situation. Items of interest and background information related to world aviation and future developments have been included. The Design Checklists cover basic essentials to be considered in airport development, together with an indication of equipment availability from Canada. A broad classification system has been proposed which can be developed to allow for requirement determination based ultimately on "level of service" to be provided. This is followed by a section containing estimates of costs which can be used to determine guideline budget requirements.

An analysis of twelve Canadian airports of varying size is included, based on information supplied by the Department of Transport. The Appendices cover listings of appropriate Canadian companies and background material supplementary to various sections of the Planning Guide.

The format has been chosen to allow for progressive updating and for additional material to be added at appropriate times.

With the rapid expansion of the world air transportation industry, there are increasing opportunities for the application of Canadian expertise and the use of Canadian manufactured equipment.

It is clear that other countries compete successfully in the international market by the serious application of joint Industry/Government effort.

It is believed that Canada's participation in this competition can be greatly increased.

This Planning Guide is intended to assist in such an effort.

CHRONOLOGY OF IMPORTANT EVENTS IN THE HISTORY OF CIVIL AVIATION IN CANADA 1858 to 1966

1858 An American balloon ascent was made over Ottawa.
1879 A Canadian-made balloon was flown by Canadians.
1902 A wind tunnel was built by W.R. Turnbull at Rothesay, N.B.
1903 First flights by Wright Brothers at Kitty Hawk, N.C.
1905 Federation Aeronautique Internationale organized at Paris, France.
1906 Lincoln Beachy flew an airship over Montreal.
1907 Towed tetrahedral kite, carrying a man, flew at Baddeck, N.S.
Aerial Experiment Association formed at Baddeck, N.S.
1908 'Red Wing', 'White Wing', 'June Bug', and 'Silver Dart' built and flown at Hammondsport, N.J.
F.W. Baldwin in 'White Wing' was the first Canadian to fly a powered heavier-than-air machine.
1909 February 23, first powered flight in Canada by J.A.D. McCurdy at Baddeck, N.S. flying the 'Silver Dart'.
August 2, demonstration flights before military officers at Petawawa by McCurdy and Baldwin flying the 'Silver Dart' carrying a passenger. 'Silver Dart' destroyed.
Bleriot crossed the English Channel.
August 12, continuation of demonstration flights using 'Baddeck 1': Military unimpressed.
1910 William Wallace Gibson designed and built the first successful aero-engine made in Canada.
The first air-meet in Canada held in Montreal. Among participants were J.A.D. McCurdy and Count Jacques de Lesseps. Three aeroplanes in the air at one time.
First radio message from an aeroplane in flight sent by J.A.D. McCurdy at New York in October.
Licence given by Aero Club of America under authority of F.A.I. (No. 18) to McCurdy on October 5.
Grace MacKenzie, the first Canadian woman to fly, flew with de Lesseps at New York October 25 (They were later married).
1911 August: cross-country air race - Toronto to Hamilton and back, J.A.D. McCurdy versus Charles Willard.
1912 Parachute jump from an aeroplane at Vancouver in May.
Altitude record: 6,000 feet set by Jimmie Ward at Winnipeg in July.
1913 Aerobatics: Armand Pegoud, a French test pilot, looped and flew inverted.
Cross-country: newspapers flown from Montreal to Ottawa by W.C. Robinson in a Lillie biplane.
1914 United States Weather Office commenced publishing daily weather charts in aid of aerial navigation. (Copies sent to Weather Office in Toronto).
Aerobatics performed by Lincoln Beachy at Winnipeg in July. Passenger flown from Toronto to Hamilton and return in May. (Passenger Marsh and pilot Macaulay).

CANADIAN AVIATION - HISTORY

1915 RFC & RNAS started recruiting and training air crews in Canada. Curtiss Aeroplanes and Motors Limited, started manufacturing aeroplanes in Toronto.

1916 National Research Council established

1917 Royal Flying Corps established training schools in Canada. Imperial Munitions Board started manufacturing aeroplanes in Toronto.

1918 Airmail flights: Brian Peck between Toronto and Montreal and return; Katherine Stinson from Calgary to Edmonton.
Armistice: November 11; all official aviation activity in Canada ceased shortly thereafter.

1919 Newfoundland: civil flying started by F.S. Cotton in a ski-equipped Martynside biplane in January.
International airmail: Vancouver to Seattle in a Boeing C3 piloted by Eddie Hubbard, in March.
Air Board (Aeronautics) Act passed on June 6.
Alcock and Brown crossed the Atlantic non-stop, June 14-15.
Canadian Pacific Railway procured a general charter permitting it to own and operate aircraft.
Airship R-34 crossed the Atlantic and returned in July.
Aerial forest patrol started by Laurentide Company in Quebec.
Rocky Mountains crossed by Ernest Hoy flying JN-4 in August. (He carried mail from Vancouver to Lethbridge and Calgary).
The International Convention for Air Navigation (ICAN) signed at Paris; Canada, as part of the British Empire, enjoyed membership.
The International Air Traffic Association (later to become the International Air Transport Association) formed at the Hague.
International air race: Toronto to New York and return, in October.

1920 Personnel licensing: first private pilots licence issued January 24 to J.S. Scott of Ottawa.
Air engineer certificate Number 1 issued April 20 to Robert McCombie of Regina.
Certificate of Registration of aircraft G-AAA issued April 20: a JN-4 owned by Aerial Service Co. of Regina.
First Commercial pilot's licence issued to J.R. Groome of Regina.
Canadian Air Force (CAF) formed on June 30.
Trans-Canada survey flight. The CAF, carrying mail, flew in relays from Halifax to Vancouver, October 7 to 17.

1921 Flight into the Northwest Territories: two Junkers aircraft owned by Imperial Oil and piloted by Fullerton and Gorman; flight planned to Norman Wells but reached only Fort Simpson, N.W.T. in March and April.

1922 R.A. Logan led expedition into the Eastern Arctic to report on flying conditions.
The National Defence Act was passed bringing the Civil Operations Branch under the Canadian Air Force.

1923 The Department of National Defence came into being January 1.
The Air Board ceased to exist.

The prefix "Royal" was added to the CAF which became the RCAF on February 15.
An improved wind tunnel was built in the aerodynamic laboratories of the University of Toronto.
Pilot training and refresher courses started at Camp Borden.
The Vickers Viking, built in Canada, was commissioned by the RCAF for use on civil projects.
Airmail flown by Stanley Cotton between Botwood, Newfoundland and Cartwright, Labrador.

1924 The Vickers Vedette, the first aircraft designed and built in Canada, was commissioned by the RCAF for forest patrol work.
First round-the-world flight completed by four U.S. Douglas biplanes. Canadian officials helped survey the Canadian portions of the route and aided in procuring supplies.
A regular airmail, passenger and freight service was operated by Laurentide Air Services between Haileybury, Ontario, and Rouyn, Quebec - the first service of its kind in Canada.
The Ontario Provincial Air Service was organized and started operations.

1925 Aerial prospecting started in earnest: Scott Williams and C.S. Caldwell explored the Liard and Yukon Rivers.

1926 Canadian Airways Ltd. started operations from Three Rivers, Quebec.
Dalzell McKee and Earl Godfrey flew by seaplane from Montreal to Vancouver.
Western Canada Airways started operations.

1927 McKee Trophy awarded to H.A. Oakes.
Flying Club Movement launched.
Hudson Strait Expedition started.
First successful variable pitch propeller in the world tested at Camp Borden.
Ship-to-shore airmail flights started between Montreal and Rimouski.
Post Office made its first appropriation ($75,000) for airmail.
Winter airmail services started: on St. Lawrence North Shore; Pelee Island; Moncton-Magdalen Islands; Yukon Territory; Rolling Portage-Red Lake.

1928 The Canadian Government adopted a new policy of operating intercity and transborder airmail services. A start was made on the Montreal-Toronto, Montreal-Ottawa and Montreal-Albany routes.
An experimental service was also started between Winnipeg, Regina, Saskatoon, Calgary and Edmonton.
A start was made on the construction of the Prairie section of the trans-Canada airway system.
The Harmon Trophy was awarded (posthumously) to F.J. Stevenson of Winnipeg.
Aerial exploration of the northern Barrens started. C.H. Dickins flew to Baker Lake, Stony Rapids and return to Winnipeg.

1929 Curtiss-Reid Aircraft Company Ltd. produced the Reid Rambler aeroplane in Montreal.
First commercial aeroplane in Canada fitted with radio telephone transmitting and receiving equipment.

Fairchild Aircraft of Canada and Bellanca Aircraft of Canada, at Montreal, de Havilland Aircraft of Canada at Downsview, had all started operations.
The Canadian Flying Clubs Association was organized in November.
Penetration of the Barrens continued. T.M. Reid, C.H. Dickins, Leigh Brintnell and others made wide sweeps around Hudson Bay and across the Northwest Territories.
The Great Depression struck the world retarding some facets of aviation.
The airmail service was extended from Toronto to Windsor and Detroit.

1930 Canadian Airways was formed by James Richardson. The Canadian National and Canadian Pacific Railways were minority stockholders.
Airship base at St. Hubert completed and the R-100 visited Canada.
Fleet Aircraft of Canada established a plant at Fort Erie, Ont.
Night airmail service started on the Prairies by Canadian Airways.
First successful Canadian crossing of the North Atlantic by J.E. Boyd and H.P. Connor.

1931 Canadian Airways operated airmail service Winnipeg to Pembina to connect with U.S. airlines serving Detroit.
First Trans-Canada Air Pageant.
Some airmail services reduced.

1932 Intercity airmail services cancelled in the East and on the Prairies.
First Webster Trophy award.
Imperial Economic Conference held in Ottawa. Experimental airmail service extended from Rimouski to Red Bay, Labrador during period of the Conference.

1933 Mackenzie Air Services started operations.
Unemployment Relief Camp established to build airports on the trans-continental airways system.

1934 West to east non-stop flight from Canadian mainland to England by Leonard Reid and James Ayling.
The Air Industries and Transport Association was founded in Ottawa.

1935 Noordyn Aviation Ltd. started building the Norseman in Montreal.
Canadian Airways operations in St. Lawrence River area taken over by affiliated company, Quebec Airways Ltd.

1936 Department of Transport came into being November 1st. Air Services Branch, consisting of Civil Aviation, Meteorology and Radio, was created.
Imperial Airways started using aircraft for making upper air observations in Newfoundland.

1937 Trans-Canada Air Lines started operating.
Trans-Atlantic airmail service started experimentally by Imperial Airways and Pan American Airways using flying boats.
First "Dawn to Dusk" flight between Montreal and Vancouver.
Aviation section of the Royal Canadian Mounted Police formed.
Airmail service established between Edmonton and Whitehorse by United Air Transport (later Yukon Southern Air Transport).

1938 TCA inaugurated its first transcontinental airmail service between Montreal and Vancouver.

CANADIAN AVIATION - HISTORY

National Steel Car opened a plant at Malton and Canadian Car and Foundry started plants for building aircraft at Montreal and Fort William.
The 'Mercury' brought a cargo of mail from Britain to Montreal.
United Air Transport inaugurated airmail service between Vancouver and Whitehorse via Fort St. John.
United Air Transport and Ginger Coote Airways merged to become Yukon Southern Air Transport Company Ltd.
Air route licensing, under an amendment to the Transport Act, was exercised by the Board of Transport Commissioners.

1939 The world's first jet-powered aircraft, the Hunkel-178 flew in Germany in August.
Canada declared war on Germany September 10.
The British Commonwealth Air Training Plan was agreed to and the selection of new airports started.
DOT was given responsibility for all airport construction in Canada.
Imperial Airways operated a weekly trans-Atlantic service to Montreal and New York.
TCA extended the Vancouver-Montreal service to Moncton.

1940 Training of pilots under the BCATP started in May. The Flying Clubs participated.
Canadian Car and Foundry started tooling up for production of Hurricanes at Fort William and Ansons at Amherst, N.S.
Canadian Pacific Railway organized Air Services Department to ferry aircraft to Britain.
Air Traffic Control was started at St. Hubert.
TCA service was extended to London and Windsor.
The Air Cadet League of Canada was authorized by Order-in-Council.

1941 The RAF Ferry Command took over the trans-Atlantic ferry service from the CPR.
De Havilland started construction of the Mosquito aircraft.
TCA began operating between Toronto and New York.
Maritime Central Airways started operations.
Airports on Edmonton-Whitehorse route were ready for day operations.
Dorval airport completed; and airports were constructed down the St. Lawrence and in the Maritimes for the Atlantic ferry service.
DOT built the Torbay airport at St. John's Newfoundland.

1942 Canadian Pacific Airlines was organized as a subsidiary of the CPR.
The Canadian Vickers Aircraft plant was completed at Montreal.
The plant of National Steel Car at Malton was taken over by the Government and reorganized as Victory Aircraft Ltd. for the construction of Lancaster bombers.
TCA extended services to St. John's, Newfoundland via Moncton, Sydney and Gander.
Work was started on the Canol and Crimson air routes.

1943 The Canadian Government Trans-Atlantic Air Service, operated by TCA under contract, started operations from Montreal to Prestwick.

1944 The Canadian Flying Clubs Association was given the prefix "Royal" and became the RCFCA.
The International Conference at Chicago produced the Convention on International Civil Aviation which provided for the organization of the International Civil Aviation Organization (ICAO).

CANADIAN AVIATION - HISTORY

The Soaring Association of Canada (SAC) was formed.
The Air Transport Board was created under an amendment to the Aeronautics Act.
The Board of Transport Commissioners relinquished the function of air route licensing when the pertinent section in the Transport Act was repealed.

1945 The BCATP was officially terminated in March.
V-E Day came on May 8 terminating hostilities in Europe.
Northwest Industries Ltd. was established in Edmonton.
A.V. Roe Canada Ltd. took over the Victory aircraft plant at Malton.
The International Air Transport Association (IATA) with headquarters in Montreal, was created by a special act of the Canadian Parliament.
TCA began operating with DC-3's.

1946 Pacific Western Airways (PWA) was organized in British Columbia.
A.V. Roe Canada Ltd. started design work on the CF-100 and the Avro Jetliner.
Atomic bombs were dropped on Japan forcing the Japanese to capitulate.
Crown-owned Turbo Research Ltd. facilities and personnel were taken over by A.V. Roe Canada Ltd. paving the way for the design and construction of jet engines.
TCA services extended to: Toronto-London-Chicago; London-Cleveland; Victoria-Seattle.
Installation of Instrument Landing Systems (ILS) started on the major airports.

1947 TCA started the Halifax-Yarmouth Saint John-Boston service.
BOAC started operations between Britain and Canada.
A.V. Roe Canada Ltd. received contract for the design and construction of the Orenda turbojet engine.
Okanagan Helicopters Ltd. was organized in Vancouver. (It expanded to become the largest such organization in the world).
TCA started using North Star aircraft.
De Havilland produced the first DHC-2 Beaver aircraft - first of a famous line of STOL aircraft.
Saskatchewan Government Airways founded to take over services and equipment from M and C Aviation.

1948 Canada's first production jet engine, the Orenda, tested at Toronto. The world's first turbojet airliner, the de Havilland Comet, was certificated.
The world's second jet and the first in North America, the AVRO CF-102 Jetliner, was flown at Malton Airport.
Fairey Aviation Co. of Canada Ltd. was established near Dartmouth, N.S.
Canadians were given the first unsurcharged airmail service.
TCA started twice-weekly service Montreal-Toronto - the Caribbean.
Air Services of DOT decentralized, establishing regional offices at Vancouver, Edmonton, Winnipeg, Toronto, Montreal and Moncton.

1949 CPA inaugurated the Trans-Pacific service from Vancouver to Sydney, Australia. The Vancouver-Tokyo-Hong Kong service was inaugurated later in the year.
Newfoundland entered Confederation March 31.

1950 Montreal claimed to be the world's air capital when the International Aviation building, housing ICAO and IATA, was opened.

CANADIAN AVIATION - HISTORY

The Orenda turbojet engine was test flown.
CPA took part in the Korean airlift.
1951 The Bristol Aeroplane Co. of Canada established in Montreal.
De Havilland produced the DHC-3 Otter.
TCA's Montreal-London service extended to Paris.
1952 TCA began operating into Germany by extending the Montreal-London service to Dusseldorf.
Rolls-Royce Montreal Ltd. became Rolls-Royce of Canada Ltd. with engine overhaul and manufacturing facilities in Montreal.
1953 CPA started services between Vancouver, Mexico City and Lima, Peru.
1954 Work started on the Mid-Canada defence line, engaging many civil air contractors.
The Canadian Aeronautical Institute was granted a charter.
TCA started using Super-Constellation aircraft.
TCA extended the Montreal-Tampa service to Mexico City.
TCA began service to Sudbury over new route: Sault Ste. Marie-Sudbury-North Bay-Montreal.
1955 A VHF -omni range (VOR) system was commissioned, linking Montreal and Windsor.
Work started on the Dew Line.
TCA introduced Vickers Viscounts into its fleet.
CPA inaugurated "Polar" route linking Sydney, Australia-Vancouver and Amsterdam.
Central Northern Airways combined with Arctic Wings Ltd. to form Trans-Air.
Route exchange between CPA and TCA became effective. TCA took over services previously operated by Quebecair. CPA acquired the Toronto-Mexico service which it operated non-stop.
1957 CPA inaugurated the Toronto-Montreal-Lisbon-Madrid service.
CPA extended South American Services to Santiago, Chile, and to Buenos Aires.
TCA started a daily non-stop service between Toronto and Vancouver using Super Constellations.
Nordair started a twice-weekly service between Montreal and Frobisher.
The Avro "Iroquois" turbojet engine (intended for use in the Arrow aircraft) was officially "unveiled" by the Minister of National Defence.
The VOR system was completed between Windsor and Winnipeg.
1958 TCA started the London, England-Winnipeg-Vancouver service.
CPA introduced Bristol Britannia turbo-propeller aircraft into its fleet.
TCA started service using Super-Constellations into Brussels and into Zurich.
The Avro C-105 Arrow was test-flown at Malton.
The de Havilland DHC-4 Caribou was test-flown at Downsview, Ontario.
Air Services of DOT organized into four directorates: Civil Aviation; Meteorology; Telecommunications; Construction.
CPA started non-stop service between Vancouver and Amsterdam.
1959 Canada celebrated the 50th anniversary of powered flight in Canada on February 23.

CANADIAN AVIATION - HISTORY

CPA was granted one daily domestic service between Vancouver, Winnipeg, Toronto and Montreal.
TCA started a service to Vienna.
Her Majesty Queen Elizabeth II opened the new airport terminal at Gander - the first of the big terminals to be built at all the large centres in Canada.

1960 TCA placed DC-8 turbojet aeroplanes in service and took delivery of its first Vickers Armstrong Vanguard aircraft.
The Department of Transport established an administrative and technical training school at Uplands, near Ottawa. (The school now gives 88 courses and handles over 1000 students a year).
Canadair made test flights on the CL-44 aircraft.
DOT completed the installation of 15 Raytheon Airport and Airways surveillance radar (AASR) units across Canada.
TCA commissioned a $20 million aircraft and engine overhaul plant on the Dorval airport at Montreal.
The Quebec Provincial Government started its own air service for forest fire patrol and suppression purposes.

1961 The Air Industries and Transport Association divided to form the Air Transport Association of Canada and the Air Industries Association of Canada.

1963 Eastern Provincial Airways purchased Maritime Central Airways to form "Eastern Provincial Airways (1963) Limited".

1965 TCA changed its name to Air Canada in January by act of Parliament.
Air Canada took delivery of the first DC-9 aircraft.

1966 July: Arrangements completed between Canada and the U.S.S.R. for a weekly air service between Montreal-Copenhagen-Moscow to be operated by Air Canada and Aeroflot.
ATB membership increased from three to five and the Board empowered to license an air service without reference of the Minister, by amendment to the Aeronautics Act.
Canada-U.S.A. transborder air route agreements were revised giving Air Canada and CPA "deep penetration" into the U.S. market.
A new policy for regional air carriers announced. The ATB given a positive role and empowered to: transfer routes; intervene in the purchase of new aircraft; grant subsidies.

The preceding chronology was extracted from "Voyageurs of the Air" - Bibliographical Ref. (1)

CANADIAN AVIATION - CURRENT SITUATION

Canada is the second largest country in the world in terms of territory. Much of this is rugged, northern terrain, poor in population but rich in natural resources. Air travel was ideal for the north and Canada's "bush" pilots, flying aircraft on skis and pontoons, did much to develop the region so that by 1929 Canadian pilots, flying in the wilds, had made possible the development of a rich mining industry.

Aviation activity in Canada increased enormously during the Second World War and it was partly in recognition of its important place in the field that the Chicago Convention in 1944 unanimously chose Montreal as headquarters of the Provisional International Civil Aviation Organization. It has been retained as such by the permanent organization.

Today, Canada depends greatly upon air transportation to effectively tie together the many communities lying across the approximately four million square miles that constitute the land mass. Air transportation brings the country together, as did the railways after the Confederation of Canada in 1867.

There are approximately 1,600 aerodromes in Canada. This number is made up of civil facilities, both licensed and unlicensed, plus a number of military airports. There are 105 mainline airports, 85 of the largest being operated and maintained by the Department of Transport. Since the Second World War, more than $620,000,000 has been invested in land and facilities for 92 of the licensed airports operated by the Department.

More than $150,000,000 has been spent since 1959 on new passenger terminal buildings and related works at 20 of the Department's major airports; simultaneously, substantial sums have been spent at lesser Departmental airports and in contributing to the development and operation of other Canadian airports within the national system.

In 1966 the publicly-owned airline, Air Canada, ranked eighth among air carriers in passengers carried, tenth in passenger-miles, seventeenth in freight, ninth in fleet size, and tenth in staff.

The other major Canadian air carrier, Canadian Pacific Airlines, ranked high in passenger-miles, taking first place in aircraft utilization through efficient planning.

Six large domestic operators serve all those parts of Canada which are not served by Air Canada or Canadian Pacific Airlines. The scheduled operations, combined with charter, executive, and private flying, place Canada in the world's second position in the use of aeroplanes.

CANADIAN AVIATION – CURRENT SITUATION

In world aviation, Canada's rank in 1967 was as follows (figures to nearest million):

PASSENGER- KILOMETERS PERFORMED (SCHEDULED SERVICES)

1967 – TOTAL SERVICES (Domestic and International)

1	United States	160,579,000,000
2	United Kingdom	14,723,000,000
3	Canada	11,101,000,000

1967 – INTERNATIONAL OPERATIONS

1	United States	23,346,000,000
2	United Kingdom	12,686,000,000
3	France	8,808,000,000
4	Germany (Federal Republic)	5,140,000,000
5	Canada	5,022,000,000

1967 – DOMESTIC OPERATIONS

1	United States	127,233,000,000
2	Canada	6,079,000,000

TONNE – KILOMETERS PERFORMED (SCHEDULED SERVICES)
(Passengers, Cargo and Mail)

1967 – TOTAL SERVICES (Domestic and International)

1	United States	19,244,000,000
2	United Kingdom	1,752,000,000
3	Canada	1,236,000,000

1967 – INTERNATIONAL OPERATIONS

1	United States	3,739,000,000
2	United Kingdom	1,561,000,000
3	France	1,077,000,000
4	Germany (Federal Republic)	732,000,000
5	Netherlands	651,000,000
6	Canada	554,000,000

1967 – DOMESTIC OPERATIONS

1	United States	15,505,000,000
2	Canada	682,000,000

Statistics derived from the ICAO Special Report "Civil Aviation in 1967" – ICAO Bulletin May – June 1968

CANADIAN AVIATION - CURRENT SITUATION

Recent unprecedented expansion and development in the field of aviation has intensified problems, with respect to passenger, freight, and ground handling capabilities at airports.

Planning to meet developing demands entered a stepped-up phase some 18 months ago with the formation of an aviation systems planning group, under the Civil Aviation Branch of the Department of Transport, with the immediate objective of planning for the new air age at Toronto and Montreal international airports.

In addition to its own committees, the Department hires consultants to aid in the systems planning of individual airports as sub-systems of the national transportation system. Thus far, consultants have been engaged to prepare 20-year master development plans for airports at Toronto, Montreal, Winnipeg and Calgary.

Several innovations, including in-flight Customs, Immigration and Health inspections, are expected to facilitate Canadian inspection procedures appreciably.

The Department is in the final stages of testing a new semi-automatic air traffic control system which will begin operations in the Gander Oceanic Control Centre at Gander, Newfoundland, in 1968. The purpose of the system, which is known as the Gander Automatic Air Traffic System (GAATS), is to facilitate the planning function associated with the entry of eastbound turbo-jet trans-atlantic flights to the Gander oceanic area, and to provide printed flight progress strips for both eastbound and westbound flights for the tactical sector controllers.

In recent years, aircraft manufactured and certified in Canada have included a long range transport (freighter) aircraft and numerous STOL aircraft powered by both reciprocating and turbine engines. In addition, one type of turbine engine has been certified which has received world-wide acceptance. Certification programmes for a utility transport amphibian aircraft, another STOL aircraft and a gyro-plane are being carried out.

A major project is underway to produce airworthiness requirements which will be distinctly Canadian. It is proposed to title the requirements "Canadian Civil Airworthiness Requirements". When the document is published all aircraft and aircraft products manufactured in Canada or imported into Canada will be required to show compliance with the new Canadian requirements.

There are 714 commercial air carriers operating the various types of air services in Canada, and holding one or more valid operating certificates issued by the Minister of Transport. Of this number, 403 are Canadian air carriers and 311 are of Commonwealth and other countries.

In 1967 there were 32,775 nautical miles of designated low altitude airways, 8,704 nautical miles of low altitude air routes, and 28,739 nautical miles of high altitude airways.

The following is a summary of the field of operations covered by the Department of Transport and the branches and commissions for which the Minister of Transport is responsible.

Bibliographical Ref.(4)

CANADIAN AVIATION - CURRENT SITUATION

THE DEPARTMENT OF TRANSPORT

The Department of Transport was formed in November, 1936, by the amalgamation of the functions of the Department of Railways and Canals, the Department of Marine, and the Civil Aviation Branch of the Department of National Defence. Total staff now numbers nearly 19,000. Apart from its administrative organization, it has two principal operating services, Air and Marine, each headed by an assistant deputy minister.

Within the administrative body are the organizations under, respectively, the Assistant Deputy Minister, General; the Director General, Personnel; the Director, Operational Review; Senior Financial Advisor and the Director, Transportation Policy and Research. There is a Department of Transport representative in London, England.

AIR SERVICES

Air Services responsibilities are carried out by five branches: Civil Aviation, Telecommunications and Electronics, Meteorological, Construction Engineering and Architecture and Airports and Field Operations, each reporting to the Assistant Deputy Minister, Air. Air Services staff now totals around 11,285 persons.

- CIVIL AVIATION BRANCH

The Civil Aviation Branch has the responsibility to encourage the development of Canadian aviation and of ensuring that aviation is safe and reliable.

The branch produces the standards for training and licensing of aircraft and personnel, air carriers, flying schools, fixed base operators, and for airways, airports, meteorological requirements and related aviation services. It also ensures, through inspection, that these standards are applied consistently across Canada.

The enforcement of regulations in the realm of aviation is a function of major importance. The branch develops airworthiness requirements to guide manufacturers in the production of aircraft and design approval is granted after an inspection has been carried out to ensure that the requirements have been met. Inspection in this sphere extends to air carriers, general aviation, manufacture and overhaul stock shops, and to aircraft maintenance engineers.

Development of air traffic control procedures and the control of air traffic is another responsibility. This involves training of staff, development and implementation of new equipment and liaison with international organizations, as well as with military aviation authorities. The department operates 39 air traffic control towers across Canada.

CANADIAN AVIATION - CURRENT SITUATION

The branch is responsible for the maintenance, servicing and operations of the departmental air fleet. This includes 45 fixed wing aircraft used for inspection and training purposes and for transporting Cabinet officials and senior government executives on official business trips. There are also 25 helicopters used, for the most part, in ship-to-shore operations and ice reconnaissance for the Canadian Coast Guard during the Transport Department's annual summer resupply work in the Arctic. They are also used in lighthouse supply and search and rescue work, as required.

Air accident investigation is an important feature of the branch activities. The branch also carries out operational research projects and other special studies related to the work of its various divisions.

There are nearly 9,000 civil aircraft in Canada, of which more than 5,700 are privately-owned. There are more than 25,000 licensed pilots and more than 403 Canadian air carriers holding operating certificates.

- TELECOMMUNICATIONS & ELECTRONICS BRANCH

This branch administers national and international radio regulations and submarine cable regulations; co-ordinates and plans government use of telecommunications and recommends policies in relation to Canada's participation in international commercial telecommunication systems; carries out research and development; constructs, maintains and operates radio and other electronic aids and facilities for air navigation, marine navigation, meteorological purposes and for satellite communications.

The branch is responsible for government telecommunications planning and is adviser to Treasury Board on such matters.

It is also responsible for the Administrative Telecommunications Agency which co-ordinates all the telephone service for government offices in Ottawa, and for improvements to government telephone and related communications facilities across the country.

Radio stations regulated total 105,000 and include all kinds from TV broadcasting to telephone microwave to ship radar. Extensive monitoring and inspection activities are required. To avoid conflicts between stations, engineering standards for equipment are developed and enforced. A service is operated for investigating man-made sources of interference to radio reception.

Participation in international conferences on telecommunications averages about 400 man-days. Satellite communications development has been prominent in this work recently.

The following electronic aids are maintained: Aviation Beacons 230; VOR Airway, 55; Instrument Landing Systems, 46; Precision Approach Radar, 8; Airway Surveillance Radars, 16; LF/MF Radio Ranges, 63; Aeradio Communication Stations, 111; Marine Communication Stations, 51; Marine Beacons, 115; Marine Ship Calibrating Beacons, 10; Loran "A" Stations, 6; Decca Stations, 15; Meteorological Radar, 14; Meteorological Radiotheodolites, 20; Airport Surveillance Radars, 45; Runway Visual Range Computers, 3; Ceilometers, 8; Transmisometers, 5; Tacans, 31; Loran "C" Stations, 1.

A ground station for experimental/operational satellite communications with Britain and Europe is being established in Nova Scotia under international co-operative agreements.

- METEOROLOGICAL BRANCH

The Meteorological Branch has headquarters in Toronto with field operations supported from regional offices at Moncton, Montreal, Toronto, Winnipeg, Edmonton and Vancouver. It has a meteorological surface observing network of approximately 300 stations linked by teletype, radio and telephone supplying weather reports to the meteorological forecast system.

The forecast system consists of the Central Analysis Office at Montreal, weather controls at Halifax, Winnipeg, Edmonton, and Vancouver, and one planned for central Canada. In addition there are a number of weather offices throughout the country which, with the support of the weather Central, provide weather information and forecasts to industries and the general public. An Ice Central at Halifax, using information provided by aerial reconnaissance and reports from shipping, provides information on the location, condition and anticipated movement of ice in the Gulf of St. Lawrence and East Coast waters in winter and in the Arctic shipping lanes in summer.

Supplementing the meteorological observing network is a climatological observing network comprising around 2,200 stations, from which reports are received each month. The meteorological observing stations are manned by full-time observers, the climatological stations being operated, generally speaking,by volunteer observers.

An upper air network of 33 stations makes regular high-altitude weather observations. Weather observations are also provided voluntarily by around 140 merchant and other ships operating in Canadian and foreign waters. A "Weatherfax" system, providing facsimile weather maps to 85 locations, has a circuit mileage of around 15,900 airline miles.

The branch is responsible for all phases of meteorological service for civil and military purposes, and for shipping in the Canadian portion of the Great Lakes and in Canadian coastal waters.

CANADIAN AVIATION - CURRENT SITUATION

- CONSTRUCTION ENGINEERING & ARCHITECTURAL BRANCH

The department's $100,000,000 major air terminal building programme, which got under way in the Fifties, is now virtually completed. Handsome new buildings were erected at Gander, Halifax, Montreal, Ottawa, Toronto, Winnipeg and Edmonton.

The final link in the chain of major terminals will be a $22,730,000 terminal complex at Vancouver International Airport. It is expected to be opened in 1968.

Besides the major terminals, the department has built or is building new terminals or has extended and renovated, smaller existing ones at some 30 airports in a multi-million dollar construction programme that began in 1952 and is still in full swing. The buildings in this scheme range from fairly large structures such as the $1,500,000 Regina terminal to smaller but equally comfortable buildings like the $100,000 Penticton, B.C. terminal.

Others are at St. John's and Stephenville, Nfld.; Sydney, N.S.; Fredericton and Moncton, N.B; Bagotville, La Malbaie, Quebec City, Seven Islands and Val d'or, P.Q.; Lakehead, London, North Bay, Sault Ste. Marie and Windsor, Ont.; Saskatoon and Uranium City, Sask; Grande Prairie, Alta.; Fort Nelson, Kamloops, Port Hardy, Prince George, Prince Rupert, Victoria and Williams Lake, B.C.; and Cambridge Bay, Fort Smith, Inuvik and Yellowknife, N.W.T.

Other improvements such as lengthened or strengthened runways, taxiways, airport lighting and navigational aids are continually being carried out in a 10-year programme that started in 1957.

- AVIATION SYSTEMS PLANNING GROUP

With air travel entering a new era, the new mobility developing will render present aviation facilities obsolete. The Boeing 747, the SST's and the all-cargo C5A are major advances in aviation technology. It has been recognized that similar progress must occur in planning and administration to meet this challenge. Consequently a total systems approach to air transportation planning has been adopted.

The planners in the Department have evolved systems planning techniques which are assisting in the development of facilities and procedures which will allow the new aviation technology to achieve its full potential in Canada. Efforts are made to correlate the overall Air Transportation System with the planning being done for other forms of public transport in the total transportation network.

Twenty-Year Master Plan Reports for the airports at Montreal, Toronto, Vancouver, Winnipeg and Calgary have been prepared in conjunction with Consultants to the Department.

CANADIAN AVIATION- CURRENT SITUATION

- AIRPORTS AND FIELD OPERATIONS BRANCH

The Airports and Field Operations Branch is responsible for administration and maintenance of all Canadian airports that are owned by the Department of Transport. It also administers a program of financial assistance for the operation and maintenance of municipal airports used by scheduled airlines on a regular basis.

The branch advises on the use and management of airport land and buildings and on the planning of air terminal buildings. It develops and establishes standards for airport operations and maintenance; it also directs the maintenance of buildings, utilities and mechanical equipment and the fire and accident prevention programs for airports. It develops policy on sources of revenue and makes recommendations on rentals, fees and service charges at airports.

There are 987 airports (367 licensed, 558 unlicensed, 62 military) and 640 seaplane bases (378 licensed, 262 unlicensed) in Canada. The Department of Transport operates 118 of the airports and 24 of the seaplane bases. The military forces and private individuals or companies operate the rest.

MARINE SERVICES

The Marine Services include the following Branches:

The Marine Operations Branch is responsible for the Canadian Coast Guard fleet, the principal duty of which is the tending of lighthouses, buoys and other aids to navigation in Canadian coastal and inland waters.

The Shipbuilding Branch prepares the basic requirements for new vessels required by the Canadian Coast Guard and supervises the design and specifications for construction. The branch also performs this work for other Government departments such as the Department of Fisheries and the Canadian National Railways.

The Marine Works Branch maintains lights, buoys, beacons, markers, fog signals and other aids to navigation on Canada's coastal and inland waters and administers public harbours and secondary canals.

The Marine Hydraulics Branch performs the work of the department in relation to provision of navigable channels for water transportation on the Great Lakes and St. Lawrence River. It deals with the hydraulic and engineering aspects of water transport from the head of the Great Lakes to the sea.

CANADIAN AVIATION - CURRENT SITUATION

The Marine Regulations Branch inspects Canadian commercial ships over 15 tons to ensure the safety of their construction and equipment, both during construction and in operation. Prevention of oil pollution of Canadian waters has been an important operation and the department has instituted helicopter patrols to strengthen its enforcement program in this regard. The branch also is in charge of ship registration, pilotage, the examination of masters, mates and seamen, and other marine regulatory matters.

CANADIAN TRANSPORT COMMISSION

The Canadian Transport Commission was established in September 1967. The commission absorbed the former Board of Transport Commissioners, Air Transport Board and Canadian Maritime Commission, which became the Railway Transport Committee, Air Transport Committee and Water Transport Committee respectively of the commission. The members of these former agencies were designated as Commissioners of the Commission.

There has also been established a Motor Vehicle Transport Committee, although the section of the Act respecting this form of transportation has not, as of this date, been brought into force. Provision exists, in another part of the Act also not yet in force, for the establishment of a Commodity Pipeline Transport Committee. Such a Committee has not, as of this date, been established.

The functions of the Railway, Air and Water Transport Committees remain largely what they were when the committees were separate entities, but with such integration of approach to transportation as is dictated by the objectives of the legislation.

ST. LAWRENCE SEAWAY AUTHORITY

The St. Lawrence Seaway Authority was established in 1951 and came into force in 1954. The Authority was incorporated for the purpose of constructing, maintaining and operating, in conjunction with works undertaken by the St. Lawrence Seaway Development Corporation in the United States, a deep waterway between the Port of Montreal and Lake Erie.

Tonnage for the Montreal-Lake Ontario section during 1966 totalled 49,249,358 tons -- up 13.5 per cent over 1965. The Welland Canal in the same period recorded a total of 59,271,666 tons, an increase of 11 per cent from the previous year.

CANADIAN AVIATION - CURRENT SITUATION

AIR CANADA

Air Canada now operates more than 63,690 miles of air routes, directly serving 60 communities in Canada, the United States, the United Kingdom, continental Europe, Bermuda, the Bahamas and the islands of the Caribbean. The airline now has 86 turbine powered aircraft, including 23 Vanguards, 39 Viscounts and 18 DC-8s, and six DC-9s.

During 1966 the airline carried 5,293,561 passengers, flew 74,628,000 ton-miles of air freight, 6,289,000 ton-miles of air express goods, and 19,081,000 ton-miles of air mail.

More than 14,000 persons are employed by Air Canada. The airline's principal maintenance bases are located at Montreal and Winnipeg.

CANADIAN OVERSEAS TELECOMMUNICATION CORPORATION

The Canadian Overseas Telecommunication Corporation is a Crown company created in 1949 to acquire for public operation external communications assets in Canada. The agreement was designed to bring about the consolidation and strengthening of radio and cable communication systems of the Commonwealth.

Among major undertakings of the corporation have been the opening of three sectors of the Commonwealth round-the-world cable system, between Canada and Britain, CANTAT (opened in 1961), between Vancouver and Sydney, Australia (opened in 1963), and the third section of the round-the-world system, SEACOM (opened in 1967).

CANADIAN NATIONAL RAILWAYS

The Canadian National Railways, administered by a Board of Directors, at the end of 1966 had 34,803 miles of operated track, of which 32,590 miles were owned, 62 miles were leased and the remainder operated under trackage rights arrangements.

A total of 38 companies are included in the Canadian National system, including concerns operating in the fields of water and rail transportation, in hotels and real estate and in telecommunications.

The Canadian National Railways system is the only one serving all Canadian provinces.

WORLD AVIATION - CURRENT SITUATION

"The problems connected with future airports add up to one of the greatest challenges ever to confront the air transport industry. No longer is it possible to isolate portions of the problem, nor is it possible to propose isolated solutions. The interaction of problems and solution is so subtle, so pervasive, that the industry has virtually run out of choice.

If there is to be a solution, then the requirement is a broad frontal attack. Above all, there must be co-ordination. A combined and co-operative effort has to be made by all concerned - economic planners, zoning authorities and ground transport operators in addition to airport authorities, governmental civil aviation departments and the airlines, and immigration, health and customs authorities. The time has come for all in the air transport industry to consider the airport as a whole. It must be treated as an asset, not a liability.

The urgent need is to strike a compromise between the multitude of conflicting requirements which face the airport planner. These requirements concern the needs and desires of the air traveller, or the shipper and the airlines, of the Government, immigration and health authorities, and the aircraft designer. Also there are the needs and desires of the man who provides services to the airport, and of the taxpayer. This is why the task of the airport planner is so formidable. This is why it is so important for all concerned to co-operate in defining the problem and seeking the optimum solution".

Bibliographical Ref. (6)

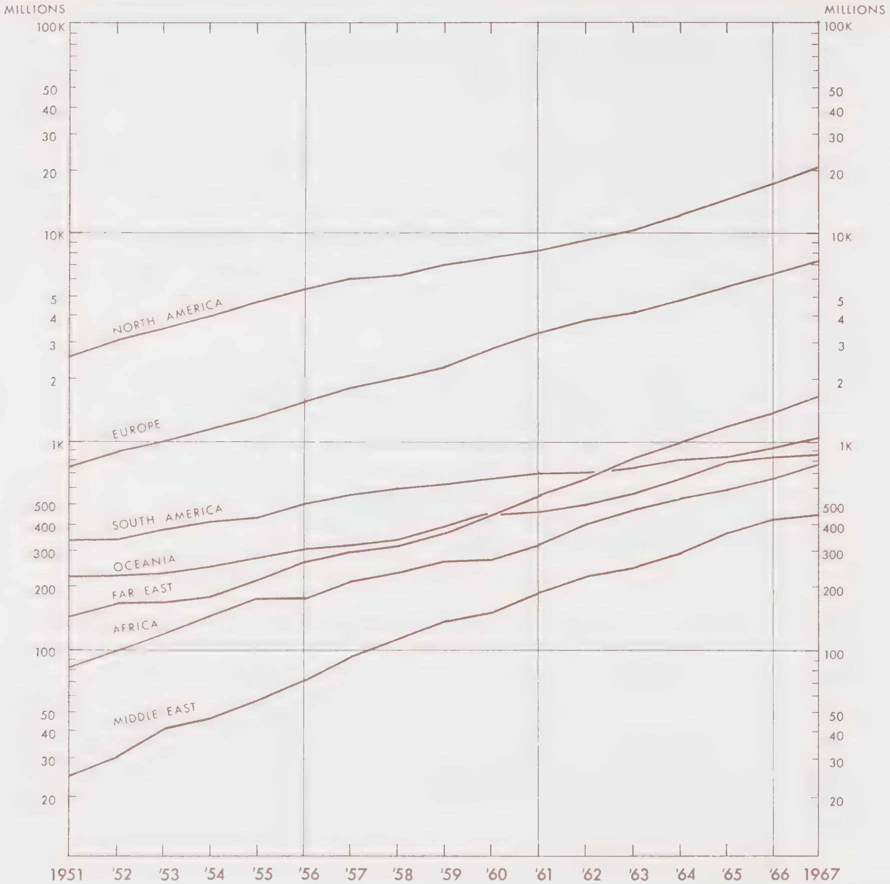
Increasing activity in the form of international conferences of those involved with all aspects of the air transportation industry during 1967 and 1968 is evidence of the universal recognition that the need for effective planning of airports, with their facilities and services, has become critical.

In the ICAO Council's Annual Report, a record year of growth for air transportation throughout the world in 1967 was reported. The highlights included increases of 20 percent for passenger traffic and 15 percent for freight volumes. The airline safety record showed a marked improvement and there has been a continuing trend toward greater inter-airline and inter-government co-ordination and co-operation.

The long-term regional trends of total tonne-kilometers performed by the scheduled services of airlines registered in the Contracting States of ICAO from 1951 to 1967 are indicative of the growth during that period.

WORLD AVIATION - CURRENT SITUATION

LONG-TERM REGIONAL TRENDS - TOTAL TONNE-KILOMETERS PERFORMED BY SCHEDULED SERVICES (INTERNATIONAL AND DOMESTIC) OF ICAO REGIONS



K = thousands

Figures shown for each region include all operations of airlines registered in the region. The regions are divided on a geographical basis as used in U.N. statistical publications. (North America includes Panama and all countries to the north as well as the Caribbean States and territories; Oceania includes Australia, New Zealand, and neighbouring islands). Derived from ICAO Special Report "Civil Aviation in 1967" - May-June 1968

WORLD AVIATION - CURRENT SITUATION

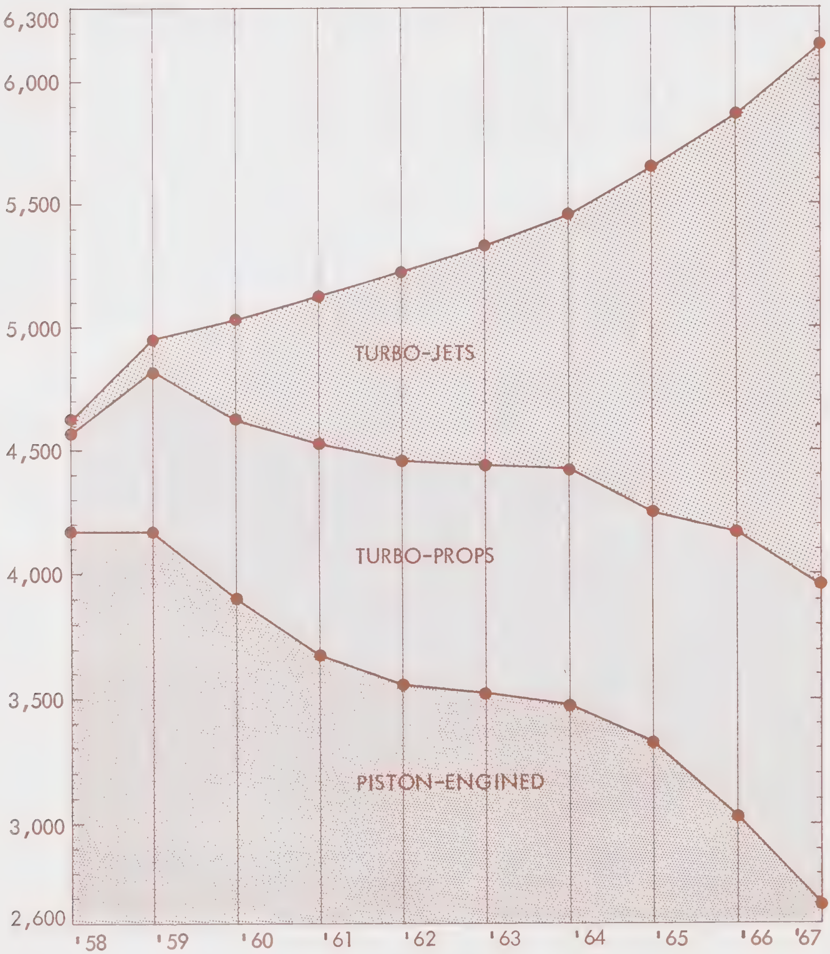
Present IATA predictions indicate the following:

- world scheduled airline passenger traffic, compared with 1965, will triple by 1975, and increase by about four times by 1985.
- world air passengers are expected to increase from 177 million in 1965 to some 580 million in 1975 and 770 million in 1980. (Some sources predict that by the end of the century, the flow of air travellers may well reach 1 billion per year).
- international air passenger traffic is forecast to continue to grow more rapidly and to increase about five times by 1980, with even higher growth rates expected on some international routes.
- world air freight traffic is forecast to increase at a faster rate than passenger traffic to 1980. Compared with 1965, freight ton-miles are expected to increase nearly six times by 1975 and about twelve times by 1980.
- the size and composition of the world's scheduled airlines operating fleet will have a considerable effect on airport requirements. The trends indicated by the numbers of aircraft in service at the end of each year from 1958 to 1967 will continue. By 1975 the fleet should total 7,600 aircraft, increasing to 8,500 aircraft by 1980, with 80% of the fleet consisting of jets. The introduction of high-capacity jets and supersonic transports will affect the size and composition of the fleet, and will compound the demands imposed on airport facilities.
- aircraft movements (arrivals and departures) on the world's scheduled air services are expected to increase from 15 million movements in 1965 to about 24 million in 1975, and 30 million in 1980. This slower rate of growth forecast for aircraft movements is expected to result from the operation of larger numbers of more productive jet aircraft.
- recent passenger traffic trends at 65 major world airports, when related to world traffic forecasts, indicate that the top 25 of these airports may have to handle three to five times as many passengers in 1975 and four to eight times as many in 1980 as they did in 1965.
- this means that at least eight of these airports will handle about 20 million passengers annually by 1980, and four of them more than 45 million passengers.
- airline traffic should benefit from rapid world population growth and a continuation of economic expansion during the 1970's, especially in the industrially advanced countries.

Bibliographical Ref. (7)

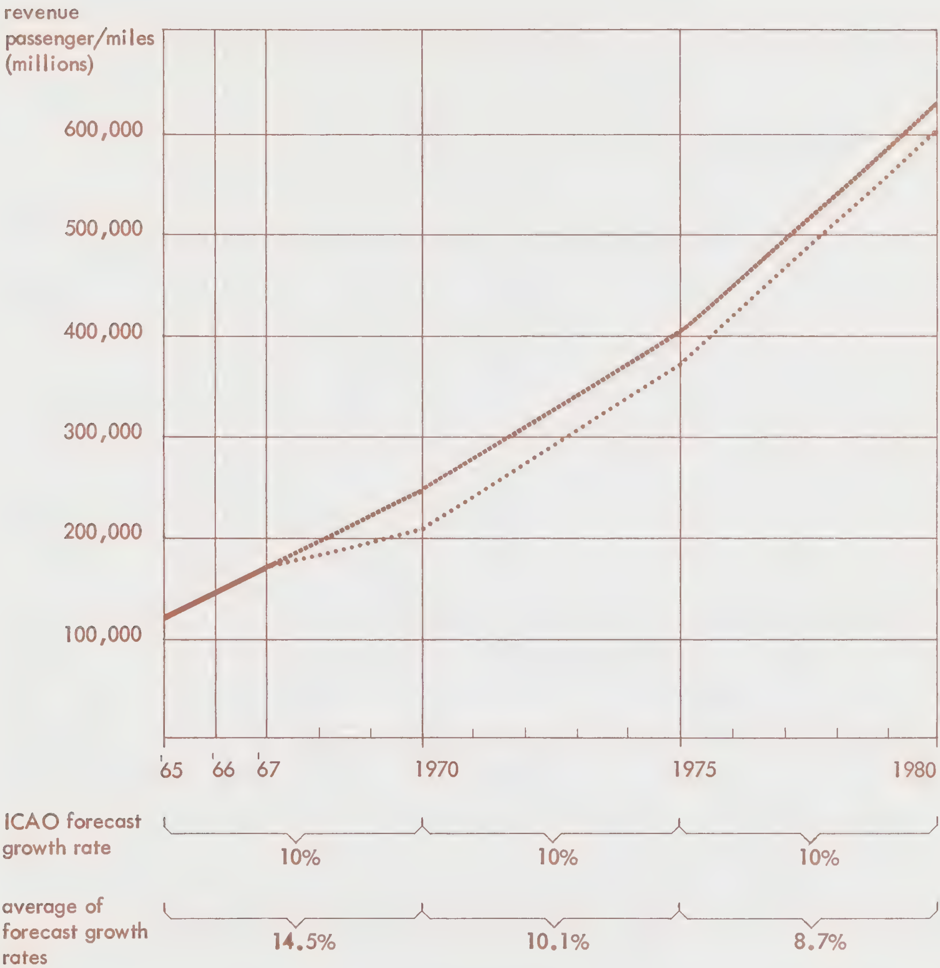
WORLD AVIATION - CURRENT SITUATION

WORLD CIVIL TRANSPORT FLEET (ICAO STATES)
- NUMBER OF AIRCRAFT IN SERVICE AT END OF EACH YEAR 1958 - 1967



Aircraft having maximum take-off weight of 20,000 lbs excluded. Numbers of piston-engined aircraft are approximations. Derived from ICAO Special Report "Civil Aviation in 1967" - May - June 1967.

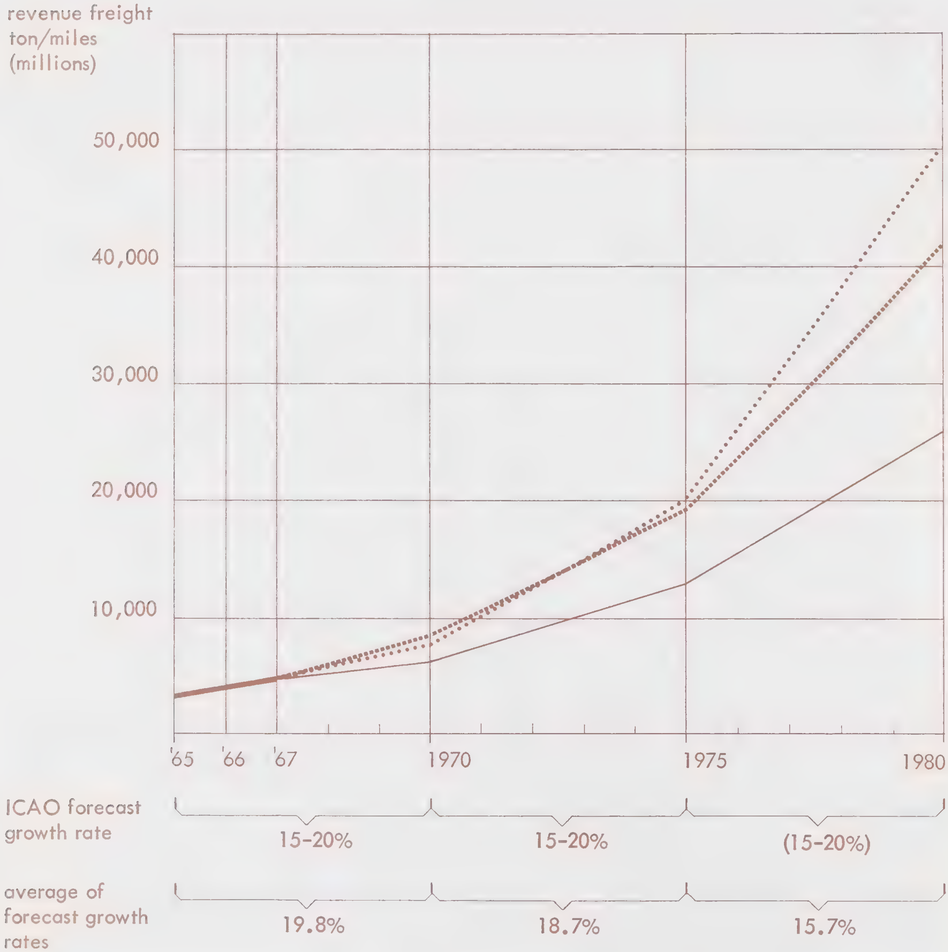
WORLD AVIATION – PASSENGER TRAFFIC FORECAST



World air passenger traffic forecast (ICAO contracting states). The ICAO forecast up to 1975 is projected to 1980. The average forecast is derived from forecasts by ICAO, Boeing, Douglas and Lockheed.

= Actual
= ICAO Forecast
= Average of Forecasts

WORLD AVIATION – AIR CARGO TRAFFIC FORECAST



World air cargo-traffic forecast (ICAO contracting states). The ICAO forecasts up to 1975 are projected to 1980. The average of forecasts is derived from forecasts by ICAO, Boeing, Douglas and Lockheed.

= Actual
= ICAO Forecast (20% G.R.)
= ICAO Forecast (15% G.R.)
= Average of Forecasts

WORLD AVIATION – ECONOMIC PROJECTIONS

MEDIUM ESTIMATES – POPULATION, GNP, AND GNP PER CAPITA

COUNTRIES (ranked by 1965 population)	Rank '65	Population (nearest million)			Rank '65	GNP($US 1965) (billions)			Rank '65	GNP per capita ($US 1965)		
		1965	1975	1985		1965	1975	1985		1965	1975	1985
CHINA	1	755	903	1052	7	74	121	196	27	98	134	186
INDIA	2	487	616	761	10	48	79	128	25	99	128	169
USSR	3	231	260	296	2	297	484	788	12	1288	1850	2660
UNITED STATES	4	195	222	256	1	692	1075	1669	1	3557	4850	6510
PAKISTAN	5	115	157	209	20	11	17	28	28	91	109	134
INDONESIA	6	105	131	168	21	10	14	19	26	99	107	112
JAPAN	7	98	107	116	6	84	173	356	15	857	1620	3080
BRAZIL	8	82	112	149	13	23	36	56	20	280	319	372
W GERMANY (incl W Berlin)	9	59	61	64	3	112	175	271	7	1905	2850	4230
NIGERIA	10	58	78	108	26	5	7	12	29	83	94	107
UNITED KINGDOM	11	55	57	58	4	99	146	216	8	1804	2580	3750
ITALY	12	52	54	56	8	57	88	137	13	1101	1620	2440
FRANCE	13	49	54	58	5	94	146	227	6	1924	2710	3920
MEXICO	14	43	60	84	16	19	30	47	19	455	503	558
POLAND	15	32	35	39	11	30	49	80	14	962	1396	2054
THAILAND	16	31	41	52	27	4	7	12	24	126	170	239
UNITED ARAB REPUBLIC	17	30	40	53	25	5	9	16	23	166	221	295
ARGENTINA	18	22	26	29	19	11	16	24	18	492	629	831
CANADA	19	20	23	28	9	48	79	128	3	2464	3360	4550
ROMANIA	20	19	21	22	18	14	24	38	16	757	1143	1717
SOUTH AND SW AFRICA	21	18	24	32	22	9	14	22	17	503	598	699
COLOMBIA	22	18	25	34	24	5	7	11	21	277	298	322
E GERMANY (incl E Berlin)	23	17	17	18	12	27	44	71	9	1574	2529	4065
CZECHOSLOVAKIA	24	14	15	16	15	22	36	58	10	1554	2357	3638
TAIWAN	25	12	16	19	29	3	5	9	22	221	314	456
AUSTRALIA	26	11	13	16	14	23	34	50	4	2009	2568	3218
SWEDEN	27	8	8	8	17	19	29	42	2	2497	3535	5078
NEW ZEALAND	28	3	3	4	23	5	7	10	5	1932	2250	2544
ISRAEL	29	3	3	4	28	3	6	11	11	1334	1949	2978

Derived from "Surprise-Free" Economic Projections, Chapter III of "The Year 2000 – A Framework of Speculation on the Next Thirty-Three Years" by Kahn and Wiener. Bibliographical Ref. (8)

WORLD AVIATION - DEVELOPMENTS

APPLICABLE TECHNICAL INNOVATIONS

Because air transportation is one of the world's most dynamically developing industries, it is necessary that all aspects be examined in the light of future technical innovations, both predictable and possible. In the realm of science and technology (with an emphasis on technology), the areas in which it is probable that technological innovation will occur in the last third of the twentieth century, bearing in mind those areas affecting the development of air transportation, are as follows:

- multiple application of lasers and masers for sensing, measuring, communication, cutting, heating, welding, power transmission, illumination, destructive (defensive), and other purposes.
- extreme high-strength and/or high temperature structural materials.
- new or improved superperformance fabrics (papers, fibers, and plastics).
- new or improved materials for equipment and appliances (plastics, glasses, alloys, ceramics, intermetallics, and cermets).
- new airborne vehicles (ground-effect machines, VTOL and STOL, super-helicopters, giant and/or supersonic jets).
- extensive commercial application of shaped-charge explosives.
- more reliable and longer-range weather forecasting.
- intensive and/or extensive expansion of tropical agriculture and forestry (socio-economic effects).
- new sources of power for fixed installations (e.g. magnetohydrodynamic, thermionic, and thermoelectric and radioactivity).
- new sources of power for ground transportation (storage battery, fuel cell, propulsion (or support) by electro-magnetic fields, jet engine, turbine, and the like).
- extensive and intensive worldwide use of high altitude cameras for mapping, prospecting, census, land use, and geological investigations.
- new methods of water transportation (such as large submarines, flexible and special purpose "container ships", or more extensive use of large automated single-purpose bulk cargo ships).
- new techniques for preserving or improving the environment.
- inexpensive design and procurement of "one of a kind" items through use of computerized analysis and automated production.
- more sophisticated architectural engineering (e.g. geodesic domes, "fancy" stressed shells, pressurized skins, and esoteric materials).
- widespread use of nuclear reactors for power.
- general use of automation and cybernation in management and production.
- extensive and intensive centralization (or automatic interconnection) of current and past personal and business information in high-speed data processors.
- other new and possibly pervasive techniques for surveillance, monitoring, and control of individuals and organizations.

WORLD AVIATION - DEVELOPMENTS

- some control of weather and/or climate.
- other (permanent or temporary) changes - or experiments - with the overall environment (e.g. the "permanent" increase in C-14 and temporary creation of other radioactivity by nuclear explosions, the increasing generation of CO_2 in the atmosphere, projects Starfire, West Ford, and Storm Fury).
- new and more reliable "educational" and propaganda techniques for affecting human behaviour - public and private.
- practical use of direct electronic communication with and stimulation of the brain.
- new techniques for very cheap, convenient, and reliable birth control.
- general and substantial increase in life expectancy, postponement of aging, and limited rejuvenation.
- generally acceptable and competitive synthetic foods and beverages (e.g. carbohydrates, fats, proteins, enzymes, vitamins, coffee, tea, cocoa and alcoholic liquor).
- "high quality" medical care for undeveloped areas (e.g. use of medical aides and technicians, referral hospitals, broad spectrum antibiotics, and artificial blood plasma).
- permanent manned satellite and lunar installations - interplanetary travel.
- permanent inhabited undersea installations and perhaps even colonies.
- extensive use of robots and machines "slaved" to humans.
- new uses of underground "tunnels" for private and public transportation and other purposes.
- automated universal (real time) credit, audit and banking systems.
- greater use of underground buildings.
- new and improved materials and equipment for buildings and interiors (e.g. variable transmission glass, heating and cooling by thermoelectric effect, and electroluminescent and phosphorescent lighting).
- mechanical and chemical methods for improving human analytical ability more or less directly.
- inexpensive and rapid techniques for making tunnels and underground cavities in earth and/or rock.
- major improvements in earth moving and construction equipment generally.
- individual flying platforms.
- inexpensive high-capacity, worldwide, regional, and local (home and business) communication (perhaps using satellites, lasers, and light pipes).
- practical home and business use of "wired" video communciation for both telephone and TV (possibly including retrieval of taped material from libraries or other sources) and rapid transmission and reception of facsimiles (possibly including news, library material, commercial announcements, instantaneous mail delivery, other printouts and so on).
- pervasive business use of computers for the storage, processing, and retrieval of information.
- shared time (public and interconnected?) computers generally available to home and business on a metered basis.

WORLD AVIATION - DEVELOPMENTS

- other widespread use of computers for intellectual and professional assistance (translation, teaching, literature search, medical diagnosis, traffic control, crime detection, computation, design, analysis and to some degree as intellectual collaborator generally).
- very low-cost buildings for home and business use.
- personal "pagers" (perhaps even two-way pocket phones) and other personal electronic equipment for communication, computing, and data processing program.
- direct broadcasts from satellites to home receivers.
- inexpensive (less than $20), long lasting, very small battery operated TV receivers.
- home computers to "run" household and communicate with outside world.
- maintenance-free, longlife electronic and other equipment.
- home education via video and computerized and programmed learning.
- widespread use of improved fluid amplifiers.
- conference TV (both closed circuit and public communication system) methods of surveillance, monitoring, and control).
- common use of (longlived?) individual power source for lights, appliances, and machines.
- inexpensive worldwide transportation of humans and cargo.
- inexpensive road-free (and facility-free) transportation.
- extensive genetic control for plants and animals.
- new biological and chemical methods to identify, trace, incapacitate, or annoy people for police and military uses.
- artificial moons and other methods for lighting large areas at night.
- extensive use of "biological processes" in the extraction and processing of minerals.

(These items have been extracted from the list of "one hundred technical innovations very likely in the last third of the Twentieth Century", Table XVIII of Chapter I of "The Year 2000 - A Framework for Speculation on the Next Thirty-Three Years" - Bibliographical Ref.(6)

ELECTRONICS, COMPUTERIZATION, INFORMATION PROCESSING

Possible future developments cannot be examined without considering the effects of the technological developments which will occur in the next quarter century in the fields of electronics, computers, automation and information processing. These fields represent probably the most dynamic and volatile of our technologies.

In the last decade basic electronic technology has progressed spectacularly, and the changes foreseeable for the next decade, much less the next quarter century, are equally impressive. Present technology permits the manufacture of 100 to 500 integrated circuits on a silicon wafer 1 inch in diameter and less than one-hundredth of an inch thick. A complete computer and communications sub-system containing more than 1,000 circuits, each with more than 400 transistors, can be manufactured on half-dollar-size silicon ships less than one-eighth inch thick.

As a result of innovations the cost of complex circuits is dropping, and together with the reduction in cost is an increase in reliability and a great reduction in the volume required for complex electronic packages. All of these will have great effects on the availability of cheap electronic equipment, both ground based and airborne.

There has been an amazing record of increase in potentiality over the last fifteen years in the field of computers. Using as a basic standard of measurement the size of the memory space divided by the computer's ability both to hold and to process information, then over the last fifteen years this criterion of computer performance has increased by a factor of ten every two or three years. Experimental parallel processing computers are to be developed which will provide a data processing speed 500 to 700 times that of existing computer systems, and more than 100 times faster than any computer known to be in development. Other means of increasing computer capabilities include using basic computational units that operate on the basis of matrices rather than single numbers, large scale improvement in the system of programming language, treating complex operations as single units and combining them in both parallel and hierarchical operations, and so on.

A decade ago a programme containing 5,000 instructions was considered quite large. Today, with increased computer capacities and new programming languages an individual can handle programmes about ten times larger, and a team may easily produce a programme still larger by a factor of five to ten. Programmes that used to take an hour or two to run now take a few seconds.

Based on these current rates of progress in computer capacity, all current concepts of computer limitations may have to be reconsidered.

It is undoubted that among the many uses of computers over the next quarter century and up to the end of this century, will be included applications for worldwide communication, medical diagnostics, traffic and transportation control, weather prediction and control, and so on. Increased applications related to statistical data storage and for forecasting are undoubted.

WORLD AVIATION - DEVELOPMENTS

Other applications in the fields of engineering and technological design will include the use of newer "problem-oriented" computer language, time-sharing, and new input-output techniques, allowing engineering designers linked to a larger computer complex to be provided with mathematical analyses of optimum design, sources of catalogues on engineering standards and parts, and to be offered a substitute for mechanical drawing processes.

The indication is that the computer utility industry will become as fundamental as the power industry, and that the computer will be regarded as the most basic tool of the last third of the twentieth century.

> "Individual computers (or at least consoles or other remote input devices) will become essential equipment for home, school, business, and profession, and the ability to use a computer skilfully and flexibly may become more widespread than the ability to play bridge or drive a car (and presumably much easier)." Bibliographical Reference (8)

The increasing utilisation of automation will have principally a twofold effect on the air transportation industry.

Firstly, it is anticipated that for the near future, certainly when considering the more developed nations, automation and cybernation will create as many jobs as they eliminate, by contributing to the increase in productivity and economic growth. The net effects on employment, hours worked and productivity, although difficult to predict, will almost certainly result in increased leisure time available to society. This, combined with increased personal income, reduced airfares, and increased speed, will result in an increased interest in travel for pleasure, vacations and so on.

Secondly, the application of automation to the transfer processes of the airport interface will tend to increase operational efficiency. Systems already in use and being developed for materials handling will reduce aircraft turnaround times with respect to baggage and cargo. Fuller use of automation for aircraft servicing and maintenance will increase utilisation.

When automation is applied to information rather than machines, and the application is in conjunction with computerisation, then there are great improvements in methods of acquiring, processing, storing, retrieving and using information.

The anticipated developments in information processing systems will improve the accuracy of forecasting (for phased development planning); increase the efficiency of air traffic control systems, weather forecasting systems, and passenger reservation systems; and reduce time delays involved in inspection processing (health, immigration, customs).

AIR TRAFFIC CONTROL

With the rapid increase in air transportation volumes great emphasis has been laid on the necessity for improving the efficiency and safety of traffic control systems in the en route and terminal airspaces as well as on the ground.

Developments in control systems for en route airspace include such systems as GAATS, the Gander Air Traffic System mentioned previously.

The heart of this system is an IBM 1801 processor controller. Input-output devices on-line to the system, exclusive of the console printer-keyboard, include a paper tape punch and a paper tape reader, five IBM printer keyboards, three IBM 1053 printers and three programmed keyboards which were designed to Department of Transport Specifications.

The system provides for two modes of operation: a free track mode and a combined organized track/free track mode. Both modes used stored meteorological forecast - wind, temperature and tropopause height values - in the calculation of geographical fix estimates. Three forecasts are maintained in the meteorological table to permit interpolation of forecast values in accordance with time and consistent with the dynamic atmospheric changes within the volume of airspace of concern.

For eastbound flights the system provides conflict prediction and conflict resolution between 50°W and 10°W longitude and the printing of flight progress strips at the high level ocean planner's position and at the high level domestic sector and oceanic sector control positions. For westbound flights it provides for the printing of flight progress strips at the high level planner, domestic sector, and oceanic sector positions, containing fix estimates in real time, as opposed to estimated elapsed times in minutes from a previous position. Bibliographical Reference (3).

The introduction of satellite systems, particularly for position determination over ocean and undeveloped land masses, will assist in en route air traffic control in the near future. The proposed OMEGA system will cover the world with eight satellites.

Among the possible uses of lasers are included the potentially most important application in communications. Very low transmission losses of power could be obtained with laser beams, and hence very long-distance transmission of information is feasible. Earth-based lasers and laser-carrying satellites are likely to be preferred means of precise tracking and communicating with satellites and moon stations. Developments in this field, together with the millionfold increase in communication capacity which would result from switching from current broadband communications (frequencies in the billions of cycles per second) to laser light waves (frequencies in the hundreds of trillions of cycles per second), and expected developments in radar coverage, will greatly improve air traffic control capabilities. Developments in collision-avoidance systems and automation of control of aircraft will also play their part.

International conferences in 1967 examined means of increasing capacity at high density airports

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such as the following:

- reduced radar spacing
- computer-aided final approach sequencing
- sequencing by aircraft speed classes
- segregation of aircraft by performance characteristics
- more uniform scheduling of operations
- separation of general aviation operation from air carrier operation
- reduction of runway occupancy times
- improved runway/taxiway layouts to increase runway acceptance rates.

In Canada, current traffic volumes warrant computerised Air Traffic Control in Gander and Moncton (North Atlantic Route), Montreal and Toronto. At present, cost/benefit analysis related to traffic increases indicates that other Canadian airports do not yet warrant computerised ATC.

In the United States, the establishment of a Common Instrument Flight Rules Room to serve air traffic control in the New York City Terminal Area has been announced. This Terminal Area encompasses three major and numerous satellite airports accommodating instrument operations and is one of the busiest complexes in the world.

The basic objective in the establishment of the Common IFR Room is to achieve more efficient utilisation of airspace by providing a control environment with face-to-face controller co-ordination capability which will support flexibility in the routing and control of flights and thereby minimize delays.

Large-screen projected displays are included, with an alphanumeric system providing "on-the-display" aircraft identification, actual altitude, beacon code, ground speed and other flight data in association with the aircraft position on a continuing basis through automatic tracking.

A development recently recorded in the United States is that of a high-speed deflection yoke for large screen cathode ray tube displays. This development has made it possible to intermix radar, television, graphic material, direct optical images, infra red data, alphanumeric characters and slide material for simultaneous presentation on a single screen. It provides high speed capability for both cathode ray tube displays and large screen projection. The enlarged image produced by the system can be displayed on a 6' x 6' screen by either front or rear projection and can be employed for control of weapons delivery, satellites, air traffic, air defense or for logistics, weather plotting, reporting space tracking and so on. The development will play a part in the future when complex display systems will be commonplace for many applications including air traffic control and landing gear monitors for SST aircraft. The new technology represented makes possible high density real time presentation offering high speed combined with all solid state design.

Other recent developments which will affect air traffic control systems of the future include the

application of holography. Radar systems will be developed which will provide three-dimensional presentations utilising holographic images.

In Britain, development and installation has been ordered for a ground based landing measurement system to record the path and speed of aircraft. The aircraft landing measurement system (ALMS) is a low cost, automatic, all-weather system which will, for the first time, provide accurate computer-compatible information on all traffic at an airport. The system can be extended to correlate its record of aircraft performance with other information such as instrument landing systems signals, weather condition and a variety of environmental factors.

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AUTOMATIC LANDING SYSTEMS

- AIRBORNE EQUIPMENT

The development of "autoland" systems for commercial aircraft resulted in an increasing number of automatic landings being made in scheduled services in 1967 and 1968. The majority of these were limited strictly to those occasions when the pilot's visibility was sufficient for him to continue with a manual landing - or overshoot.

The requirement that the risk of a fatal accident being caused by the automatic system be not greater than one in ten million per landing has resulted in the development of airborne equipment which consists of two complete systems, every element of which is monitored. Only one of these systems is connected to the control surfaces - i.e. has authority - at any one time. The other is always at standby.

If the first system develops a fault, it switches automatically over to the second and disengages itself. The changeover takes less than one tenth of a second and its effect is barely discernible to the watching pilot even when he is expecting it.

If the second system fails, being "fail-passive", it switches itself off before it can cause the aircraft to begin a dangerous manoeuvre. (It should be noted that although the FAA accepts a single "fail-passive" system for operations down to Cat. 2 minima, it is likely that the above-described "failure-survival" system - required by British authorities for all automatic landings - will be mandatory for Cat. 3 operations).

The airborne equipment consists of two automatic pilot systems, each with its own monitors, two self-monitored radio altimeters and two autothrottle systems. Approach sequence and engaged state indicators are provided for each pilot and an ILS boundary indicator for the co-pilot. The ground equipment consists of an ILS of sufficient quality to give an accurate descent path and definition of the runway centreline.

During the approach, just before joining the localizer, the second auto-pilot is engaged to join the first, which the pilot has had in use during the cruise.

The maximum angle at which the localizer can be captured is 90 degrees. Just after it has been intercepted, speed is established at threshold speed plus 10 kts. (V ref plus 10 kt).

Capture of both the localizer and of the glide-slope is automatic, the pilot setting the speed required on the autothrottle system.

After the glideslope is captured the aircraft begins a three degree descent, full flap is selected and the speed cut back to V ref plus five knots.

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At about 800 ft. the radio altimeters are automatically checked out and if all is well the captain arms the flare computer in readiness for landing.

At 120 ft. above runway level the attitude-hold phase begins - the pitch attitude remains constant at an average value worked out during the previous 400 ft. of the approach.

A white light on the panels signifies "attitude hold" and a red one operates when the aircraft is outside permitted performance limits.

There is a pictorial display of these limits and the pilot is also shown which of the autopilots and autothrottles are controlling the aircraft. If both autopilots disconnect he gets an audible warning.

Similarly, there are safeguards covering disconnection or failure of the autothrottles or radio altimeters. There is also automatic protection from outside interference. Turbulence, moderate or heavy, is countered in the autopilot and wind-shear effect is avoided by an increase in approach speed.

Because beam bends and "noise" complicate guidance below 120 ft. the ILS glide path is disconnected and descent thereafter is governed by the aircraft's flare computer.

At first the aircraft is held at a constant attitude but at 50 ft. or so the flare commences and the aircraft rotates slowly to a shallow pitch-up attitude, the rate of descent dropping to about 2 ft/sec at touchdown.

The flare computer, an analogue computer, bases its control demands on the autopilot - and produces the required flare-out profile - by determining aircraft height and descent rate from the radio altimeter signals and then comparing these with a pre-set flare-out profile.

The throttles close automatically during the flare-out and the rudder channel is freed so that the pilot can kick-off drift if necessary.

After touchdown the pilot disengages the autopilot and the autothrottle to complete the landing roll manually.

Initially, landings have been automatically made with this equipment only in Category 1 weather conditions, but it will be used in Category 2 conditions and has been designed for Category 3 operations.

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- ICAO WEATHER CATEGORIES

CAT 1: operation down to minima of 60 meters (200 ft.) Decision Height and Runway Visual Range 800 meters (2,600 ft.) with a high probability of approach success. When RVR is not available, 800 m. (2,600 ft.) visibility is intended.

CAT 2: operation down to minima below 60 m. (200 ft.) DH and RVR 800 m. (2,600 ft.) and to as low as 30 m. (100 ft.) DH and RVR 400 m. (1,200 ft.) with a high probability of approach success.

CAT 3a: operation to and along the surface of the runway with external visual reference during the final phase of the landing down to RVR minima of 200 m. (700 ft.)

CAT 3b: operation to and along the surface of the runways and taxiways with visibility sufficient only for visual taxiing comparable to a RVR value in the order of 50 m. (150 ft.).

CAT 3c: operation to and along the surface of the runway and taxiways without external visual reference.

- GROUND EQUIPMENT

With respect to ILS performance and integrity, the following points should be noted.

While the visual reference phase still has much to contribute to the safety of the Cat.2 approach, nevertheless the degree of trust which can be placed in the correctness of information supplied by the ILS system becomes increasingly important as the approach in non-visual conditions is continued to lower heights. Considerable progress has been made in this direction in recent years as is evident from a comparison of the Cat. 2 systems specification with that of earlier equipment in terms of performance, accuracy and integrity.

ILS installations are presently operated at the two different standards required for Cat. 1 and Cat. 2 operations. Both meet requirements which are more stringent than those of the original unclassified ILS but increased precision is required of an ILS over and above that of Cat. 1 to satisfy the more demanding operational requirements of Cat. 2.

A Cat. 1 ILS system is required to provide guidance suitable for an approach down to at least 200 ft. Flyability is usually determined qualitively by flight test. Special precautions do not have to be taken to ensure that equipment serving the opposite landing direction is switched off and a disturbance from this source can occur if automatic flight is continued below 200 ft. Although ground stations are required to operate to high standards a somewhat lower level of reliability is accepted for a Cat. 1 system than is the case for Cat. 2.

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A Cat. 2 ILS is required to provide guidance suitable for an approach down to 50 ft. (Note that with the current generation of "auto land" the descent below 120' is governed by the aircraft's flare computer). The flyability assessment involves accurate instrumental measurement of beam bends and only those beams in which the bends are within stringent amplitude limits receive Cat. 2 certification. Where ILS is installed at both ends of a runway only one installation is allowed to radiate the signals at any one time. Special design and maintenance arrangements ensure that signal reliability meets the safety requirements of Cat. 2 operations

With reference to approach and runway lighting, ICAO has recommended the installation of a line of red barrets spaced at 100' intervals parallel and on each side of the normal centreline lights in the last 1000' before the threshold. It is likely that the white single point source lights will be replaced by white barrets thus effecting standardization in the last 1000' between the two systems. High intensity runway centreline lighting such as has been installed in Toronto together with touchdown zone lighting, are also included in the Cat. 2 recommendations.

The implementation of Cat. 2 and 3 capability at an airport must be considered in the light of the cost/benefits derived from the installation. Where I.F.R. conditions are relatively rare, it might well prove uneconomic for the system to be upgraded beyond Cat. 2. Certain major airports are equipped now for Cat. 2 operation and more are coming into operation. The implementation of Cat. 3 has not yet been firmly established, however, certain phases of Cat. 3 could be operational by 1975.

It should be noted that recommendations made during the Fifth Air Navigation Conference of ICAO, November 1967, included the following concerning secondary power supply for ground-based radio aids and visual aids.

Maximum switch-over times for radio aids requiring power for precision approach Cat. 1 operations - 10 seconds. For precision approach Cat. 2 and Cat. 3 operations: ILS Localizer and Glide Path - 0 seconds; ILS Inner and Middle Markers - 1 second; ILS Outer Marker - 10 seconds.

Maximum switch-over times for visual aids requiring power for precision approach Cat. 1 operations - 15 seconds. For precision approach Cat. 2 and Cat. 3 operations: Approach Lighting, Runway Threshold, Centreline and Touchdown Zone Systems - 1 second; Runway Edge, Essential Taxiway and Obstruction Lighting Systems - 15 seconds.

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NEW AND FUTURE AIRCRAFT

Within the next decade the average size of air transports will be double the average size today. The average distance travelled by a passenger will also be doubled. It is predicted that air cargo revenue will exceed passenger revenue by 1980.

Planning of airway and airport facilities must take into account the integration of operations of all the comtemporary and future aircraft which it is predicted will be flying during the next few decades.

One forecast of the large transports which will appear during the next 35 years, including the predicted year of introduction and predicted gross weight, is as follows:

TYPE	YEAR	GROSS WT. (lb.)
Stretched Subsonic Jets	1967/68	350,000
Jumbo Subsonic Jets	1970/71	700,000
Air Bus Subsonic Jets	1971/72	350,000
Supersonic	1972	375,000
Large Supersonic	1976	750,000
Super-Jumbo Subsonics	1980	1,000,000
VTOL Subsonics	1985	350,000
VTOL Supersonics	1990	750,000
VTOL Nuclear Supersonics	1995	1,000,000
VTOL Nuclear Hypersonics	2000	1,250,000

Bibliographical Reference (13)

The first stretched subsonic jets are in service.

Following are useful comparative statistics of current and future aircraft:

DC-8F	
Overall Length	150'8"
Overall Span	142'4"
Max. Take Off Weight	315,000 lb.
Space Payload	39,740 lb.
Total Cargo Compartment Volume	1,390 cu.ft.
Total Passenger Seats	139
Maximum Cruise Speed	550 mph (Mach 0.83)
Range (space payload, std. day)	3950 NM
B707-320 (B, C)	
Overall Length	152'11"

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Overall Span	145' 10"
Max. Take Off Weight	333,600 lb.
Space Payload	lb.
Total Cargo Volume (C)	cu.ft.
Total Passenger Seats	185
Maximum Cruise Speed	541 mph
Range (space payload, std. day)	NM

DC8-63

Overall Length	187'5"
Overall Span	148'4"
Max. Take Off Weight	350,000 lb.
Space Payload	60,980 lb.
Total Cargo Compartment Volume	2,500 cu.ft.
Total Passenger Seats	196
Maximum Cruise Speed	550 mph (Mach 0.83)
Range (space payload, std. day)	3,900 NM

B-747 (Passenger/Cargo/Convertible)

Overall Length	231'4"
Overall Span	195'8"
Max. Take Off Weight	710,000 lb.
Max. Payload (2500 NM Range)	225,000 lb.
Total Cargo Volume (Freighter)	17,640 cu.ft.
Total Passenger Seats	366 - 490
Maximum Cruise Speed	588 mph (Mach 0.89)
Max. Range (lb.payload)	NM

L-500 (Galaxy Freighter)

Overall Length	248'
Overall Span	222'8"
Max. Take Off Weight	813,300 lb.
*Max. Payload (3000 NM Range)	779,500 lb.
Total Cargo Volume	42,400 cu.ft.
Total Passenger Seats	N/A
Maximum Cruise Speed	mph
*Max. Range (324,600 lb. payload)	5140 NM

* (ISA, still air, 2 hr. holding reserve)

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L 1011

Overall Length	
Overall Span	
Max. Take Off Weight	409,000 lb.
Space Payload	
Total Cargo Volume	
Total Passenger Seats	256 - 345
Maximum Cruise Speed	
Range	

DC 10

Overall Length	
Overall Span	
Maximum Take Off Weight	386,000 lb.
Space Payload	
Total Cargo Volume	
Total Passenger Seats	250 - 300 plus
Maximum Cruise Speed	
Range	

A 300

Overall Length	
Overall Span	
Max. Take Off Weight	290,000 lb.
Space Payload	
Total Cargo Volume	
Total Passenger Seats	250 - 300
Maximum Cruise Speed	
Range	

Concorde

Overall Length	193'0"
Overall Span	83'10"
Max. Take Off Weight	367,000 lb.
Space Payload	26,260 lb.
Total Cargo Volume	570 cu.ft.
Total Passenger Seats	122
Maximum Cruise Speed	1450 mph (Mach 2.2)
Range (space payload, std. day)	3090 NM

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B-2707-100

Overall Length	318'0"
Overall Span	174'2" (open) 105'9" (closed)
Max. Take Off Weight	
Space Payload	62,000 lb.
Total Cargo Volume	2431 cu.ft.
Total Passenger Seats	280
Maximum Cruise Speed	1780 mph (Mach 2.7)
Range (space payload, std. day)	2700 NM

One of the most serious problems to be encountered with introduction of supersonic aircraft will be that of noise, both in respect of "sonic boom" as it will affect route structuring, and noise in the vicinity of airports.

Studies are currently under way covering the overall effects of variation of sonic boom transmissions caused by atmospheric irregularities, topographical focusing and variable aircraft flight paths, and the effects of sonic boom on humans, animals and structures.

The Concorde and Boeing SST's are both expected to produce an overpressure of about 2 lbs./sq.ft. during supersonic cruise conditions at operating altitude, and perhaps as much as 2.5 lbs./sq.ft. under worst case conditions while climbing. The critical phase of climb-out relative to the boom for the SST comes at about 45,000 feet while the aircraft is passing through Mach 1.8 to Mach 2.

The effects of sideline noise during take-off must be taken into account when determining airport layout and location.

Further developments of VTOL/STOL aircraft in the near future will affect airport planning, particularly where such aircraft will be used for airport to city-centre transportation or for feeder lines serving major airports. Separation of airspace and landing requirements will be desirable in many cases, to increase main runway system capacity. For all weather operations landing aids specifically developed for VTOL/STOL aircraft will preclude common operations on landing areas used by other types of aircraft.

The following pages contain an outline of the geographical locations of airports to handle projected services of B-747 and B-2707-100 aircraft as forecast by Boeing Aircraft Company. It should be noted that it is expected that the BAC - Sud Aviation Concorde will enter service in 1972, and the effects are not represented in these forecasts.

PROJECTED SERVICES – 747's and SST's
(Based on forecasts by Boeing Aircraft Company)

AREA	AIRPORT	747 1971	747 1976	SST 1976
CANADA, (ALASKA, GREENLAND)	ANCHORAGE (Alaska)	●	●	●
	CALGARY		●	●
	EDMONTON	●	●	●
	GANDER		●	●
	HALIFAX		●	●
	MONTREAL	●	●	●
	SONDRE STROMFJORD (Greenland)			●
	TORONTO	●	●	●
	VANCOUVER	●	●	●
	WINNIPEG	●	●	●
UNITED STATES	ATLANTA		●	●
	BALTIMORE		●	●
	BOSTON	●	●	●
	CHICAGO	●	●	●
	CLEVELAND		●	●
	DALLAS	●	●	●
	DAYTON		●	●
	DENVER	●	●	●
	DETROIT	●	●	●
	EL PASO		●	●
	FT. LAUDERDALE		●	●
	HARTFORD		●	●
	HONOLULU	●	●	●
	HOUSTON	●	●	●
	KANSAS CITY	●	●	●
	LOS ANGELES	●	●	●
	MIAMI	●	●	●
	MILWAUKEE		●	●
	MINNEAPOLIS	●	●	●
	NEWARK		●	●
	NEW ORLEANS		●	●
	NEW YORK	●	●	●
	OAKLAND	●	●	●
	PHILADELPHIA	●	●	●
	PHOENIX		●	●
	PORTLAND	●	●	●
	ST. LOUIS	●	●	●
	SAN ANTONIO	●	●	●
	SAN DIEGO	●	●	●
	SAN FRANCISCO	●	●	●
	SEATTLE	●	●	●

PROJECTED SERVICES – 747's and SST's
(Based on forecasts by Boeing Aircraft Company)

AREA	AIRPORT	747 1971	747 1976	SST 1976
UNITED STATES	TAMPA		●	●
	TUCSON		●	●
	WASHINGTON	●	●	●
	WEST PALM BEACH		●	●
EUROPE	AMSTERDAM	●	●	●
	BARCELONA		●	●
	BERGEN		●	●
	BRUSSELS		●	●
	COPENHAGEN	●	●	●
	DUBLIN	●	●	●
	FRANKFURT	●	●	●
	GENEVA		●	●
	GLASGOW		●	●
	HAMBURG	●	●	●
	KEFLAVIK			●
	LISBON		●	●
	LONDON	●	●	●
	MADRID		●	●
	MANCHESTER		●	●
	MILAN	●	●	●
	MOSCOW		●	●
	MUNICH		●	●
	NICE		●	●
	OSLO		●	●
	PARIS	●	●	●
	ROME	●	●	●
	SHANNON	●	●	●
	STOCKHOLM		●	●
	STUTTGART		●	●
	VIENNA		●	●
	ZURICH		●	●
MIDDLE EAST AND AFRICA	ABADAN		●	●
	ADEN		●	●
	AMMAN		●	●
	ANKARA		●	●
	ATHENS		●	●
	BAGHDAD		●	●
	BAHRAIN		●	●
	BEIRUT	●	●	●

PROJECTED SERVICES – 747's and SST's
(Based on forecasts by Boeing Aircraft Company)

AREA	AIRPORT	747 1971	747 1976	SST 1976
MIDDLE EAST AND AFRICA	CAIRO		●	●
	DAKAR		●	●
	DHAHRAN		●	●
	ELISABETHVILLE		●	●
	ENTEBBE		●	●
	ISTANBUL		●	●
	JOHANNESBURG		●	●
	KHARTOUM		●	●
	KUWAIT		●	●
	LAGOS			●
	LAS PALMAS		●	●
	LEOPOLDVILLE		●	●
	TEL AVIV	●	●	●
	TEHRAN		●	●
	TRIPOLI		●	●
ASIA AND AUSTRALIA	AUCKLAND		●	●
	BANGKOK		●	●
	BOMBAY		●	●
	BRISBANE		●	●
	CALCUTTA		●	●
	COLOMBO		●	●
	DACCA		●	●
	DARWIN		●	●
	DELHI		●	●
	DJAKARTA		●	●
	HONG KONG	●	●	●
	KARACHI		●	●
	KUALA LUMPUR		●	●
	LAHORE		●	●
	MANILA	●	●	●
	NANDI	●	●	●
	OKINAWA		●	●
	OSAKA		●	●
	PERTH		●	●
	RANGOON		●	●
	SAIGON		●	●
	SINGAPORE		●	●
	SYDNEY	●	●	●
	TAIPEI		●	●
	TOKYO	●	●	●

PROJECTED SERVICES - 747's and SST's
(Based on forecasts by Boeing Aircraft Company)

AREA	AIRPORT	747 1971	747 1976	SST 1976
SOUTH AMERICA, CENTRAL AMERICA, CARIBBEAN	ACAPULCO	●	●	●
	ANTIGUA		●	●
	ASUNCION		●	●
	BERMUDA	●	●	●
	BOGOTA		●	●
	BRIDGETOWN		●	●
	BUENOS AIRES		●	●
	CARACAS		●	●
	KINGSTON			●
	LIMA		●	●
	MEXICO CITY	●	●	●
	NASSAU		●	●
	PANAMA CITY		●	●
	PORT-AU-PRINCE		●	●
	PORT OF SPAIN		●	●
	RIO DE JANEIRO		●	●
	SANTIAGO		●	●
	SAN JUAN	●	●	●
	SANTO DOMINGO		●	●

DESIGN CHECKLISTS

2000

OUTLINE

This Section presents in itemized format an outline of essentials to be considered in airport development. Although reasonably comprehensive, the checklists do not purport to include everything applicable to a variety of situations. The prime purposes of this Section are:

- to assist in the establishment of a preliminary brief of requirements for a particular situation;
- to determine the approximate contents of a Canadian package (as applicable);
- to provide an itemized basis for determining guideline estimates (as applicable).

The first part describes briefly the need for Master Planning and outlines requirements to be considered.

The second part consists of Design Checklists for the airport itself, applied to the three Design Divisions of Airside, Interface and Landside. These checklists present a combination of functional and physical requirements for each Design Division, subdivided into Components, Elements, Items and Sub-items.

Where applicable, Specification References are given to Operational Specifications established by ICAO, IATA, DOT (Canada), FAA and other bodies. The list of Specification References is contained in Appendix D.

MASTER PLANNING

New and rapidly innovating technologies; vast political, social and economic upheavals accompanying the worldwide mushrooming of population; the continued development of mass communication; and the less spectacular but equally consequential processes of urbanization, industrialization, and modernization are obvious facets of the second half of this century. It is a truism that the pace with which such changes are taking place has reduced the reliability of practical experience as a guide to public policy and has diminished the usefulness of conventional judgment in dealing with planning problems.

> "With the growth of modern communication and transportation, we are more quickly aware of the linked consequences of change, and the need to anticipate these and to plan for them from the community to the national level. But the recognition of the need for planning involves the added dimension as well - the nature of time...
>
> In fact, especially in a post-industrial society, where human capital is the scarcest resource, planning necessarily involves long-run commitments and, with equal necessity, it requires long-run forecasting..................
>
> But planning, by its very nature, is not a mechanical process. Central to it is the problem of choice - both for the ends desired and for the allocation of resources. Thus planning and rationality are one. All this puts us on the threshold of an ancient and persistent human quest: to choose our futures".
>
> Bibliographical Ref. (6)

Had the planners responsible at all levels for the initial establishment of many of the world's airports been able to foresee the extent and the effects of the revolution in air transportation which has occured in the past two decades, and had we been able to "choose our futures", then it is undoubted that many decisions made would have been very different.

- the lack of space and flexibility for adequate expansion to meet tomorrow's needs;
- the built-in restrictions created by design concepts lacking in foresight;
- the hazards to operational safety created by airport layouts and runway designs determined "by the book" rather than by actual operational conditions - or not upgraded to meet the changing operational requirements, under all conditions, of new aircraft;
- the encroachment upon airport areas because of inadequate or unenforced zoning byelaws, together with the problems created by the increasing importance of the noise factor and the safety hazards inherent in resultant noise abatement operational procedures;
- the imbalance in airport sub-systems resulting from lack of overall planning or from wrong emphasis;

- the money and effort wasted by authorities more interested in national prestige than in meeting the actual needs, or by planners and architects more interested in building monuments to their reputations than in producing balanced solutions to the actual problems;

- the lack of sufficient flexibility in the determination of forecast demands or of facility requirements to allow for progressive updating on the one hand and of phased incremental expansion on the other;

- these are just some of the lessons we can learn from hindsight.

It is generally accepted that for any major airport development Master Planning is a necessity. The socio-economic impact of the world's future largest airports together with the vast capital investments involved make it essential that the most thorough and careful planning be executed.

In May 1968, the Chairman of the British Airports Authority described the "ideal" airport for the 1980's as consisting of four parallel runways, two for landing and two for take-off, spaced 9000' apart to allow for full linear terminal and for independent runway system operation, with the linear disposition and lateral separation of each landing/take-off combination such that taxying times be reduced to a minimum and to ensure that overshoots do not conflict with normal take-offs.

Such an idealized airport would occupy an area 6.8 miles by 3.4 miles - 26 square miles. A continuous IFR rate of 144 movements per hour would be possible. In considering noise problems, an "airport disturbance area" might be said to be a parallelogram 23 miles long and at least 4 miles wide - some 92 square miles.

No matter how large or small airport development may be, the importance of the need for Master Planning cannot be stressed too strongly.

Because Canada's Department of Transport operates most of the nation's airports, this country is in a preferred position to develop a co-ordinated approach to planning its air transportation system. The 20 Year Master Plan Reports prepared for major airports by Consultants in conjunction with the Department of Transport have utilized the Aviation Systems Approach to Master Planning. Although methodology and techniques have differed from airport to airport and Consultant to Consultant, the basic aim has been the same. (See Appendices B and C for "The Aviation Systems Approach to Master Planning" and "Scope of Work to Develop a Master Plan Report for Mainline Airports".)

Following are Checklists which outline some of the main requirements of Master Planning.

Division: TOTAL AIRPORT SYSTEM	Component: PLANNING INTEGRATION

Element	Item	Sub-item	Reference
AGENCIES AND ORGANIZATIONS	National and International	Governmental Bodies - transport or civil aviation - immigration - customs - health - security - treasury Aviation Planning Authorities Urban Planning Authorities ICAO IATA Associations - airline pilots - air traffic controllers - airport owners - airport operators Manufacturers - aircraft - equipment Airline Operators	

Division: TOTAL AIRPORT SYSTEM	Component: PLANNING INTEGRATION

Element	Item	Sub-item	Reference
SYSTEMS PLANNING	Team Disciplines	Aviation Specialist Architect Ops. Research Analyst Civil Engineer Traffic Engineer Economist Telecoms. Engineer Meteorologist	

Division: TOTAL AIRPORT SYSTEM	Component: FORECASTS

Element	Item	Sub-item	Reference
ECONOMIC	Location Suitability	Present Requirements Future Requirements	
	Status of Area Served	Present Status Future Potential - population expansion - industrial development - commercial development - cultural emphasis - social emphasis - confining factors - geographical location	
	Passenger/Cargo Movements	Historical Analysis Forecast Volumes - enplaned/deplaned - origin/destination - scheduled/non-scheduled Revenue Production	
	Competitive Position	Present and Future - other transportation modes	
	Future Land Requirements	Major Tenants - government - military - air carriers - other operations	

Division: TOTAL AIRPORT SYSTEM	Component: FORECASTS

Element	Item	Sub-item	Reference
OPERATIONAL	Route Structures	Present and Future - international - domestic - (transborder)	
	Aircraft Mix	Present and Future - air carriers - military - general aviation	
	General Aviation	Present Activity Future Activity	
	Aircraft Movements	History and Future - aircraft mix - class of operation - runway utilization	
	Inspection Services	Present and Future	
	Gate Utilization	Present and Future - scheduled - non-scheduled - charter	
	Ground Transportation	Present and Future - vehicle mix - traffic flow - public - employer - parking areas	
	Aircraft Refuelling	Present and Future - air carrier - general aviation	
	Adjacent Airports	Present and Proposed	

Division: TOTAL AIRPORT SYSTEM	Component: FORECASTS

Element	Item	Sub-item	Reference
FINANCIAL	Fixed Installations	Present Facilities - capital investments - depreciated value - current value	
	Other Assets	Value - registered zoning - easements - off- airport access roads - utilities	
	Land	Current Value History and Forecast - annual increases	
	Tax Rates	History and Forecast	
	Land Acquisition for Future Development	Cost/Benefit Comparisons	
	Operation Costs/Revenue	Present and Future	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
PEAK AIRCRAFT MOVEMENT DEMAND	Air Carrier Movements – Passenger Aircraft	Forecast Volume – economic analysis – demographic factors – statistics analysis	
		Seat Factors – historical analysis – schedule analysis – projections	
		Sector Analysis – route analysis – route projections – domestic – international – other	
		Aircraft Size Analysis – carrier eqpt. projections – technological trends – aircraft mix	
	Air Carrier Movements – Cargo Aircraft	Forecast Volume – history – mail – express – freight – economic analysis – rates and tariffs – directionality Load Factor – historical analysis – projections – all freighter/belly capacity	
		Sector analysis – route analysis – route projections – domestic – international – other	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
		Aircraft Size Analysis - carrier eqpt. projection - technological trends - aircraft mix	
	General Aviation Movements - Local	Flight School - historical analysis - pilot requirement - aircraft trends Non Flight School - air carrier - private business - carrier eqpt. plans - projections of training demand	
	General Aviation Movements - Itinerant	Private - historical analysis - domestic - international - other - private aircraft trends Other Commercial - flight school - government - civil - other - domestic - international	
	General Aviation Movements - Simulated Approachs	Elements Training Demands	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
	Military Aviation Movements		
	- Local	Historical Analysis Eqpt. Acquisitions Establishment Strength Training Requirements	
	- Itinerant	Historical Analysis Logistic Support Requirements Training Requirements	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
OPERATIONAL STUDIES	Capacity Analysis - Delay Factor	Runway Configuration - single - parallel - intersecting - open V - VFR/IRF operations Runway Use - mixed operations - landings only - take-offs only VFR Arrivals - wind direction/strength - runway length - runway occupancy - preferential runways IFR Arrivals - ILS approach paths - runway utilization - aircraft mix - runway/taxiway crossings/intersections - turnoffs/threshold - training operations VFR/IFR Departures - airport layout - climbout procedures - runway lengths - noise regulations Aircraft Mix Ratio Landings/Takeoffs Runway Geometrics - lengths - number of turnoffs - types of turnoffs - turnoffs/threshold - intersecting runways	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
		Runway Rating Departure Routes (IFR)	
	Capacity Analysis - Aircraft Spacing	Weather Operational Procedures Runway Configuration Aircraft Population Runway Geometrics Runway Use Traffic Distribution Terminal Airspace Considerations Separation Procedures Sequencing Procedures	
	Noise Studies	Abate Procedures - operational curfews - preferential runways - power reduction - climbout procedures Noise Contours - ground run-ups - approach paths - departure paths Noise Sensitivity Zones - land use zoning	
	Air Traffic Control Analysis	Terminal Airspace - overflights - route structure - stratification - short term vectoring Adjacent Airports - terminal airspace - operational character - runway alignments - control co-ordination	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
FACILITY SIZING STUDIES	Navigational Aids - En Route	Location, Zoning, Operational and Land Requirements - AASR - Decca-Detra - Radio Range - Marker Beacons - VOR - DME - NDB's	
	- Terminal	Location, Zoning, Operational and Land Requirements - ASR - SSR - DME - VOR - Radio Range - NDB's	
	Landing Aids - Non-Visual	Location, Zoning, Operational and Land Requirements - ILS system - GCA system All Weather Operations	
	- Visual	Obstruction Removal and Marking Location, Zoning, Operational and Land Requirements - approach lighting - threshold lighting/ marking - runway lighting/marking - VASIS - taxiway lighting/ marking	

Division: TOTAL AIRPORT SYSTEM	Component: AIR SUB-SYSTEM

Element	Item	Sub-item	Reference
	Land Requirements (in conjunction with Ground Sub-System)	Zoning Maneuvering Area - runways - taxiways - aprons Passenger Facility Cargo Facility General Aviation Area (Military Aviation Area) Operation Area Maintenance Area Commercial Area Road System Airport Industrial Park	
	Gate Requirements (in conjunction with Ground Sub-System)	Passenger - air carrier - general Cargo Peak Hour Movements Aircraft Mix Gate Occupancy/Delay Gate Utilization Operational Nature - domestic - internati onal Aircraft Turnaround Times Servicing Requirements	

Division: TOTAL AIRPORT SYSTEM	Component: GROUND SUB-SYSTEM

Element	Item	Sub-item	Reference
PEAK MOVEMENT DEMAND	Passenger Volumes - International - Domestic - Transfer - Transit	National Population GNP Disposable Income Historical Analysis Forecast Volumes Origin/Destination Enplaned/Deplaned Scheduled/Non-Scheduled Market Segments - socio-economic type - trip purpose - party size	
	Cargo Volumes - International - Domestic - Transfer - Transit	Historical Analysis Forecast Volumes Origin/Destination Enplaned/Deplaned Scheduled/Non-Scheduled Market Segment	

Division: TOTAL AIRPORT SYSTEM	Component: GROUND SUB - SYSTEM

Element	Item	Sub-item	Reference
OPERATIONAL STUDIES	Passenger Handling	Sequence Analysis Time Standards Processing System	
	Baggage Handling	Sequence Analysis Time Standards Processing System	
	Cargo Handling	Sequence Analysis Time Standards Processing System	
	Aircraft Handling	Sequence Analysis Time Standards Processing System	

Division: TOTAL AIRPORT SYSTEM	Component: GROUND SUB-SY.STEM

Element	Item	Sub-item	Reference
FACILITY SIZING STUDIES	Space Requirements		
	- Passenger Facility	Passenger Processing Passenger Services Baggage Processing Admin. Functions Airline Functions Public Areas Concessions Car Park Gd. Transport Terminal Building Services	
	- Cargo Facility	Cargo Processing Admin. Functions Airline Functions Customs Functions Gd. Transport Terminal	
	- General Aviation	Operations Facilities Aircrew/Passenger Processing Hangars Service/Maintenance Car Parking	
	- Airport Operations and Maintenance	Building Services Plant Equipment Storage Fire Station Operations Building	
	- Commercial Areas	Applicable Tenants	
	- Ground Transportation Systems	Road System - highway access - service roads - interconnection STOL/VTOL - landing/takeoff area - manoeuvring area - servicing area - operations facilities	

Division: TOTAL AIRPORT SYSTEM		Component: GROUND SUB-SYSTEM	
Element	Item	Sub-item	Reference
		Rapid Transit/Train - trackway - operations facilities - terminal facilities	

Division: TOTAL AIRPORT SYSTEM	Component: ECONOMIC ANALYSIS

Element	Item	Sub-item	Reference
COST ESTIMATES	Phased Development	Air Sub-system Ground Sub-system Maintenance Operation Administration	
	Cost Optimization	Handling Systems Processing Systems Structural Systems Construction Standards Environment Standards Equipment Standards	

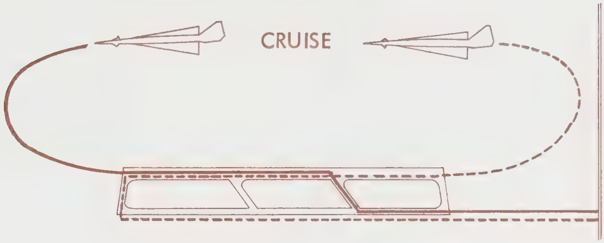
Division: TOTAL AIRPORT SYSTEM	Component: ECONOMIC ANALYSIS

Element	Item	Sub-item	Reference
IMPACT ON ECONOMY	Infra Structure	Air Transportation System Other Transportation Systems	
	Local	Tourism Job Opportunities Related Industries Disposable Incomes	

Division: TOTAL AIRPORT SYSTEM	Component: ECONOMIC ANALYSIS		
Element	**Item**	**Sub-item**	**Reference**
COST/BENEFIT ANALYSIS	Capital Investment	Financial Arrangements	
	Cash Flow	(Loan Servicing) Operation Costs Maintenance Costs Revenue	

BASIS OF DESIGN DIVISION

AIRSIDE



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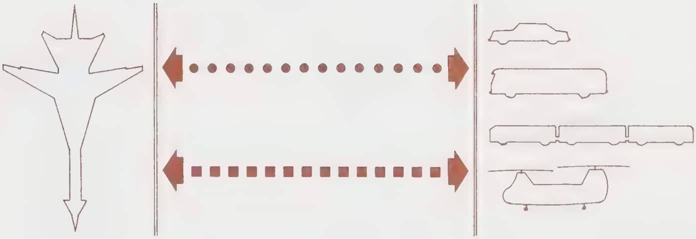

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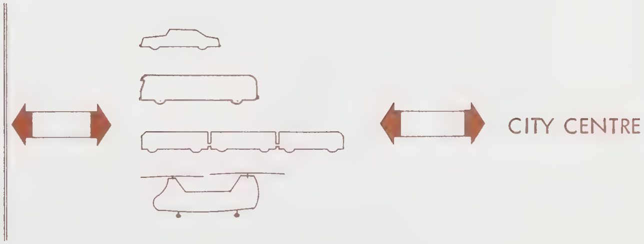
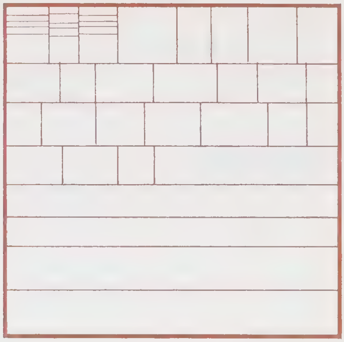


BREAKDOWN OF DESIGN DIVISION

AIRSIDE



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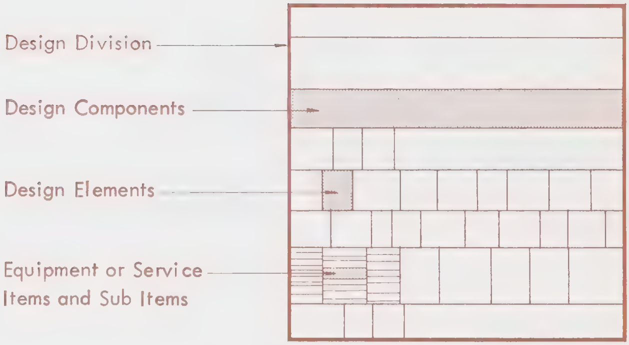

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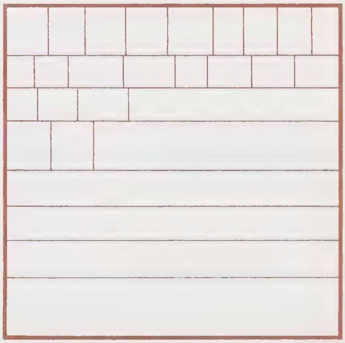


Division: AIRSIDE	Component: AIR TRAFFIC CONTROL

Element	Item	Sub-item	Reference
AIR GROUND COMMUNICATIONS	Design Criteria	International Specification Canadian Specification Other	1.1 3.1
	Function	LF - survival HF - survival - search and rescue - radio range VHF - primary - emergency - ground control - survival - international air carrier - air carriers - SELCAL UHF - primary	
	Systems	LF/HF/VHF/UHF - transmitters - receivers - antenna fields - towers - tuning/phasing equipment - antenna feed systems Ground System Audio Systems - amplifiers - distribution frame - monitoring equipment · tape · aural - line equalizers	
NOTE: See Appendix D for Specification Reference indicated in last column	Accommodation	Remote Receiver Site Remote Transmitter Site Control Tower Space	

Division: AIRSIDE	Component: AIR TRAFFIC CONTROL

Element	Item	Sub-item	Reference
	Facilities/Services	Emergency Power Test and Maintenance Rooms – shielded enclosures Regulated Quiet Power Source	
	Environment	Equipment areas – Airconditioned Humidity Controlled Clean Atmosphere Utility Finishes Efficiency Lighting	

Division: AIRSIDE	Component: AIR TRAFFIC CONTROL

Element	Item	Sub-item	Reference
GROUND-GROUND COMMUNICATIONS	Design Criteria	International Specification	1.1
		Canadian Specification	3.1
		Other	
	Function	Inter-ground Location Communication	
		- fixed radio circuits	
		- voice	
		- radio teletype	
		- facsimile	
		- meteorlogical teletype	
		- emergency	
		Ground Extensions	
		- teletypes	
		· airlines offices/desks	
		· outside locations	
		· meteorological offices	
		· regional office	
		·communications companies	
		- toll lines to Duplex Radio Teletype	
		- ATC Telephone	
		- AMIS Interphone	
	Systems	Teletype	
		- radio teletype	
		Facsimile	
		Telephone	
		Line Distribution System	
		Satellite	
	Accommodation	Control Tower Space	
		Shared Space with Air-Ground Communication Facilities	
		SatelliteGround Station(s)	
	Facilities/Services	Emergency Power	
		Line Distribution Facilities	

Division: AIRSIDE	Component: AIR TRAFFIC CONTROL

Element	Item	Sub-item	Reference
	Environment	Radio Equipment Areas - airconditioned - humidity controlled - clean atmosphere Utility Finishes Efficiency Lighting	
INTERNAL COMMUNICATION	Function Systems	Local Communications between ATC Areas - belt system - pneumatic tube - telewriter - telephone - intercom	

Division: AIRSIDE	Component: METEOROLOGICAL SERVICES

Element	Item	Sub-item	Reference
INFRASTRUCTURE	Design Criteria	International Specifications	1.1
		Canadian Specifications	3.1
		Other	
	Service Function	International National Regional Local Reporting	
OBSERVATIONS	Design Criteria Function	Canadian Specification Provide Data Concerning - ceiling - wind - upper air - atmospheric pressure - precipitation - temperature - humidity - visibility - ozone - radiation - seismic - sunshine	3.2
	Systems	Ceiling - ceilometers - ceiling height projectors - ceiling balloons - alidades	

		Upper Air
		- pilot balloons
		  - plotting equipment
		  - pibal telephone & associated equipment
		- theodolites
		- hydrogen (Helium) installations
		- GMD equipment	

Division: AIRSIDE	Component: METEOROLOGICAL SERVICES

Element	Item	Sub-item	Reference
		Wind - anemometer - anemomograph Atmospheric Pressure - barometer - barograph - altimeter setting indicator Precipitation - rain gauge - snow/gauge/ruler - evaporation indicator - ice thckness gauge - ice accretion gauge Temperature - air thermometer - soil thermometer Humidity - psychrometer Visibility - transmissometer - RVR computer Ozone - ozone indicator Radiation - geiger counter Seismic - seismograph Sunshine measuring eqpt.	

Division: AIRSIDE	Component: METEOROLOGICAL SERVICES

Element	Item	Sub-item	Reference
		Automatic Measuring Unit for - temperature - pressure - precipitation - wind velocity & direction	
		Satellite Radar	
	Accommodation	Weather Station (s) Remote Observation Site(s) Observation Equipment Housings Satellite Ground Station(s)	
	Facilities/Services	Power Maintenance Rooms Storage Space Offices Sanitary Facilities	
	Environment	Equipment & Maintenance Internal Spaces - air-conditioned - controlled humidity Utility Finishes Efficiency Lighting	
COMMUNICATIONS	Design Criteria	Canadian Specifications	3.1
	Function	Inter-Location Communication	
	Systems	UHF Voice Radio Teletype Telephone Electronic Messenger Facsimile Antenna Systems Live Distribution Systems	

Division: AIRSIDE	Component: METEOROLOGICAL SERVICES

Element	Item	Sub-item	Reference
	Accommodation	Communications Room Teletype Room	
	Facilities/Services	Power Test/Maintenance Rooms Line Distribution	
	Environment	Controlled Atmosphere Utility Finishes Efficiency Lighting	
FORECASTING	Design Criteria	Canadian Specifications	3.2
	Function	Weather Forecasting - short range - long range - local - regional/national	
	Systems	Calculators Computers Analysers	
	Accommodation	Forecasting Rooms	
	Facilities/Services	Power Office Facilities Sanitary Facilities	
	Environment	Air-conditioning Controlled Humidity Utility Finishes Efficiency Lighting	
BRIEFING	Design Criteria	Canadian Specifications	3.1
	Function	Weather Briefing to Air Crews and Others	
	Systems	Map Displays Electric Pointers Overhead Projectors	

Division: AIRSIDE	Component: METEOROLOGICAL SERVICES

Element	Item	Sub-item	Reference
	Accommodation	Briefing Room(s)	
	Facilities/Services	Power Projection Screens	
	Environment	Air-conditioning Medium Class Finishes Efficiency Lighting – Dimmable	

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element	Item	Sub-item	Reference
LONG RANGE	Design Criteria	International Specifications	1.2
	Function	Point Location from Aircraft	
	Systems	CONSOL Loran NDB - High Powered Decca-Dectra	
	Accommodation	Remote Transmitter Site Transmitter Building - transmitter room - test/maintenance room - storage - office space Antenna Field - towers and antennae - tuning and phasing - antenna feed system - ground system	
	Facilities/Services	Power - Regulated Emergency Power Sanitary Facilities Communication Facilities-to Central Office	
	Environment	Air-conditioned Utility Finishes Efficiency Lighting	

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element	Item	Sub-item	Reference.
SHORT RANGE	Design Criteria	International Specifications	1.2
	Function	Point Location from Aircraft	
	Systems	Radio Range - LF - MF VOR - with voice - TACAN - VORTAC - (VOT) DME	
	Accommodation	Remote Transmitter Site Transmitter Building - equipment room - test/maintenance room - storage - office space Antenna Field - towers & antennae - tuning & phasing - antenna feed system - ground system	
	Facilities/Services	Power - Regulated Emergency Power Sanitary Facilities Communication Facilities to Central Office	
	Environment	Air-Conditioning Utility Finishes Efficiency Lighting	

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element	Item	Sub-item	Reference
RADIO BEACONS	Design Criteria	International Specifications	1.2
	Function	Point Location from Aircraft	
	Systems	NDB – Low Powered	
		En route VHF Marker Beacons – fan markers – z markers	
	Accommodation	Remote Transmitter Site (as other Radio Navigation Aids)	
	Facilities	Power – Regulated Emergency Power Sanitary Facilities Communication Facilities to Central Office	
	Environment	Air- conditioned Utility Finishes Efficiency Lighting	

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element	Item	Sub-item	Reference
RADAR	Design Criteria	International Specifications	1.2
		Canadian Specifications	3.1
		Other Specifications	4.2,4.3
	Function	Aircraft Location by Ground Control	
	Systems	AASR	
		ASR	
		SSR	
		ASDE	
		- radar bright display equipment	
		- radar vector measuring equipment	
	Accommodation	Remote Equipment Site	
		- equipment building	
		- equipment room	
		- test/maintenance room	
		- storage	
		- office space	
		- antenna	
		- tower & dish	
		- antenna feed system	
		Radar Monitor Room	
	Facilities/Services	Power - Regulated	
		Emergency Power	
		Sanitary Facilities	
		Communication Facilities to Central Office	
	Environment	Air-conditioned	
		Utility Finishes	
		Efficiency Lighting	

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element	Item	Sub-item	Reference
MONITORING	Design Criteria	International Specifications Canadian Specifications	1.2 3.1
	Function	Continuity/Record Check of Radionavigational Aids Operation - continuous - range - VOR (all types) - NDB - local - adjacent (-ILS) - scheduled - NDB - local - adjacent - VOR - beacons (-ILS)	
	Systems	Aural Magnetic Tape Recording	
	Accommodation	Portion of Equipment Room at Remote Transmitter Site Monitor Room in ATC Tower	
	Facilities/Services	Monitor Receivers/Feeds Power Emergency Power Automatic Transfer Eqpt.	
	Environment	Air-conditioned Controlled Humidity Utility Finishes Efficiency Lighting	

Division: AIRSIDE	Component: LANDING AIDS

Element	Item	Sub-item	Reference
NON-VISUAL	Design Criteria	International Specification Canadian Specification	1.2
	Function	To provide landing aircraft with non-visual assistance	
	Systems	ILS - glide path - localizer - markers GCA - PAR - SRE PPI Automatic Landing Systems	
	Accommodation	Equipment Housings - adjacent to runways - mobile units - space in control tower	
	Facilities/Services	Power - regulated - emergency Communication Links	
	Environment	External Equipment Housings - weatherproof Interior Equipment Space - air-conditioned	

Division: AIRSIDE	Component: LANDING AIDS

Element	Item	Sub-item	Reference
VISUAL	Design Criteria	International Specification Other	1.3,1.4 4.3
	Function	To - provide landing aircraft with visual assistance - indicate runway location - indicate stopway and taxiway locations - indicate obstruction locations	
	Systems	Landing Assistance - wind direction indicators - landing direction indicators	
		Location Aids - signs - beacon lights - identification beacons	
		Signalling Lamps	
		Runway Markers - designation - center line - threshold - distance - touchdown zone - interruption - edge - daylight markers for snow covered runways	
		Stopway Day Markers	
		Taxiway Markers - taxi holding position	
		Obstruction Markers - day - lighting	

Division: AIRSIDE	Component: LANDING AIDS

Element	Item	Sub-item	Reference
	Accommodation	Nil	
	Facilities/Services	Power for lighting aids - controlled - emergency Power Conduit System - underground	
	Environment	Weather-resistant Weather - proof	

Division: AIRSIDE	Component: LANDING AIDS

Element	Item	Sub-item	Reference
LIGHTING AIDS	Design Criteria	International Specification	1.4
		Canadian Specification	3.1
		Other	4.3
	Function	To - provide landing aircraft with illuminated assistance - indicate runway location - indicate stopway and taxiway locations	
	Systems	Approach Lights - non-instrument runways - low intensity - high intensity - controlled intensity - instrument approach runways - low intensity - high intensity - controlled intensity - precision approach runways - low intensity - high intensity	
		Visual Approach Slope Indicators	
		Circling Guidance Lights	
		Approach Light Beacons	
		Runway Alignment Indicators	
		Runway Lights - edge - high intensity	

Division: AIRSIDE	Component: LANDING AIDS

Element	Item	Sub-item	Reference
		– medium intensity – low intensity	
		– threshold – high intensity – medium intensity – low intensity	
		– centre line – high intensity	
		– touchdown zone – highest intensity	
		– fixed distance	
		– identification (RIL) – condenser discharge	
		Stopway Lights	
		Taxiway Lights – edge – centre line – guidance	
		Runway and Approach Light Control System	
		Monitoring Systems	
	Accommodation	Interior location for control equipment	
		Remote control position and status indication in control tower	
		Monitoring equipment indication in control tower	

Division: AIRSIDE	Component: LANDING AIDS

Element	Item	Sub-item	Reference
	Facilities/Services	Power - regulated - emergency	
		Towers for Elevated Lights	
		Underground Conduit System	
	Environment	Weather-proof Long Life Bulbs	

Division: AIRSIDE	Component: MANOEUVRING AREA

Element	Item	Sub-item	Reference
RUNWAYS	Design Criteria	International Specifications Canadian Specifications Other	1.3
	Functional Considerations	Orientation - wind distribution - usability Siting Effects of Approach Surfaces Number Operational Procedures Safety	
	Geometrics	Lengths - temperature - elevation - route structures Widths Slopes - longitudinal - transverse Separation Intersections Declared Distances - TORA - ASDA - TODA - LDA Clearways/Stopways - lengths/locations - widths - slopes Strips - widths - slopes	
	Structural Considerations	Flexible Pavements Rigid Pavements - strengths - soil tests/classification - subgrade classification	

Division: AIRSIDE	Component: MANOEUVRING AREAS

Element	Item	Sub-item	Reference
		- pavement loadings - traffic volumes - pavement thicknesses Surface Treatment Drainage Strip Strengths	

Division: AIRSIDE	Component: MANOEUVRING AREAS

Element	Item	Sub-item	Reference
TAXIWAYS	Design Criteria	International Specifications Canadian Specifications Other	1.3
	Functional Considerations	Traffic Volumes Number Operational Procedures Safety	
	Geometrics	Widths Slopes - longitudinal - transverse Junctions Intersections High-speed Turnoffs Fillets Minimum Clearances Strips - widths - slopes	
	Structural Considerations	Flexible Pavements Rigid Pavements - strengths - subgrades - loadings - traffic volumes - pavement thicknesses Surface Treatment Drainage Strip Strengths	

Division: AIRSIDE	Component: MANOEUVRING AREAS

Element	Item	Sub-item	Reference
APRONS	Design Criteria	International Specifications Canadian Specifications Other	1.3
	Functional Considerations	Traffic volumes - passengers - cargo/mail - general aviation - maintenance - military - base operations Manoeuvring Space - clearances Safety	
	Geometrics	Areas Locations Slopes	
	Structural Considerations	Flexible Pavements Rigid Pavements - strengths - subgrades - loadings - traffic volumes - pavement thicknesses Surface Treatment Drainage Built-in Systems - fuel - power - aircraft servicing.	

Division: AIRSIDE	Component: AIRPORT SERVICING AND MAINTENANCE

Element	Item	Sub-item	Reference
RUNWAY CLEARANCE	Design Criteria	International Specification Other	1.4,1.5 4.3
	Function	To clear runways and aircraft movement areas of snow, slush, ice, dust, gravel	
	Systems	Snow/Slush Removal - snow plows - snow blowers - snow sweepers - CABASS Machines Sanding Machines - with flame thrower - with sprinkler - with pre-heater Ice Removal - chemical - flame thrower - sawdust Dirt Removal - sweepers	
	Accommodation	Vehicle Storage Space - maintenance facilities Sand/Grit Storage Crew Quarters	
	Facilities/Services	Communication in Each Vehicle Building Services to Vehicle and Crew Locations	
	Environment	Vehicle Building - efficiency lighting - utility finishes	

Division: AIRSIDE	Component: AIRPORT SERVICING AND MAINTENANCE

Element	Item	Sub-item	Reference
		Crew Building - utility lighting - utility finishes	
FOG DISPERSAL	Design Criteria	International Specification	1.5
	Function	Remove Fog from the Area of Active Runways	
	Systems	Turbojet System FIDO	
	Accommodation	Underground Equipment Locations Adjacent to Runways	
		Fuel Storage	
	Facilities/Services		
	Environment	Outdoor	
BIRD DISPERSAL	Design Criteria	-	
	Function	Remove birds from the Area of Active Runways	
	Systems	Audible Devices Chemical Methods Falconry Microwave Radiation	

Division: AIRSIDE	Component: SAFETY AND EMERGENCY

Element	Item	Sub-item	Reference
FIRE SERVICES	Design Criteria	International Specifications	1.4
		Canadian Specifications	3.1
		Other Specifications	4.3
	Systems	Fire Trucks	
		- conventional	
		- hook	
		- ladder	
		- hose	
		- pumper	
		- foam truck	
		- large	
		- small	
		- water truck	
	Accommodation	Fire Station	
		Extinguishing Agent Storage	
		- water 300 to 5,000 gals	
		- foam 90 to 270 gals	
		- dry chemicals	
		- CO_2	
		- vaporizing liquid	
		Vehicle Maintenance & Storage	
		Hose Tower	
		Watch Tower	
	Facilities	Personnel Quarters	
		Toilets	
		Food	
		Communications	
		- VHF	
		- telephone	
		- fire alarm	
		- automatic fire detectors	
	Services	Power	
		- standby	

Division: AIRSIDE	Component: SAFETY AND EMERGENCY

Element	Item	Sub-item	Reference
	Environment	Utility finishes Efficient lighting Air-conditioning in personnel areas	
CRASH SERVICES	Design Criteria	International Specification	1.4
	Function	Passengers and crew rescue after a crash	
	Systems	Rescue Trucks Rough Terrain Vehicles - tracked - wheeled - hovercraft	
	Accommodation	Vehicle Storage & Maintenance	
	Facilities	Communications - VHF - telephone	
	Services	Power - standby	
	Environment	Utility Finishes Efficiency Lighting	
MEDICAL SERVICES	Function	Provide crash victims and others with medical assistance	
	Systems	Nurse Truck Ambulance	
	Accommodation	First Aid Room Air Disaster Unit - complete with operating room facilities, etc., as small hospital	

Division: AIRSIDE	Component: SAFETY AND EMERGENCY

Element	Item	Sub-item	Reference
	Facilities	Communications - VHF - telephone - public address	
	Services	Power - regulated - standby Water	
	Environment	Air-conditioned - clean air Critical Lighting Min. Maint. Finishes	
AIRCRAFT REMOVAL SERVICES	Design Criteria	International Specifications	1.4
	Function	Remove crashed or disabled aircraft from the operational areas	
	Systems	Vehicles - cranes - 50 ton - tow units - trailers Equipment - hydraulic jacks and accessories - hand tools	
	Accommodation	Vehicle and Equipment Storage & Maintenance	
	Facilities	Communications - VHF	
	Services	Power - standby	
	Environment	Utility Finishes Efficiency Lighting	

Division: AIRSIDE	Component: AIRCRAFT SERVICE AND MAINTENANCE

Element	Item	Sub-item	Reference
AIRCRAFT MOVING FACILITIES	Design Criteria	International Specification	2.1
	Function	Move Aircraft From Parking Location to Ramp Position	
	Systems	Tractor Towing Equipment Auxiliary Wheel Drive Devices	
	Accommodation	Unit Storage & Maintenance	
FIXED SERVICING FACILITIES	Design Criteria	International Specification	2.1
	Function	Provide Servicing Facilities For Aircraft on the Ramp	
	Systems	Fuel - types - storage tanks - piping systems - hydrants - flowmeter/flow regulating equipment - quantity measuring equipment - filters - bulk loaders Oil - oil tankers - storage tanks Electrical Power - distribution system - apron supply points	

Division: AIRSIDE	Component: AIRCRAFT SERVICE AND MAINTENANCE		
Element	**Item**	**Sub-item**	**Reference**
		Water - storage or supply systems - distribution system	
		Grounding Facilities - grounding points - connection system	
		Cabin Temperature Control	
		Apron Drainage Systems - trapped drain inlet system - non-trapped drain system - grated open trench system	
	Accommodation	Centrallized Fuel and Oil Storage and Pumping Stations	
	Facilities	Fire Alarm - automatic fire detectors Fire Prevention - sprinkler/foam system Tanker Unloading Facilities	
	Services (at Stations)	Power - standby	
	Environment (at stations)	Utility Finishes Efficiency Lighting Air Circulation - conditioning	
MOBILE SERVICING FACILITIES	Design Criteria	International Specification	2.1
	Function	Provide mobile servicing facilities for aircraft on the ramp	
	Systems	Service Vehicles - Essential	

Division: AIRSIDE	Component: AIRCRAFT SERVICE & MAINTENANCE

Element	Item	Sub-item	Reference

		- fuel trucks/pumpers
		- oil carrier
		- portable water carrier
		  - cooling water
		  - drinking water
		- toilet servicing truck
		  - sewage disposal system
		- refuse cart
		  - garbage disposal system
		- line maintenance truck
		- cabin service truck
		- power & lighting unit
		- fire extinguisher equipment carrier
		- catering truck
		- baggage carts
		  - cargo trucks
		- fork lift truck
		- tractors
		- radio service truck
		- loading platforms
		- aircraft cleaning equipment
		- fire extinguishers
		- wheel chocks
		
		Service Vehicles - Additional
		- water methanol (A.D.I.) carrier
		- de-mineralized water cart
		- de-icing fluid carrier
		- de-icing fluid spray carrier
		- de-fuelling truck
		- air-conditioning or cabin heat unit
		- compressed air cart
		- conveyor belt units
		- engine starters
		  - pneumatic
		  - turbine	

Division: AIRSIDE	Component: AIRCRAFT SERVICE & MAINTENANCE

Element	Item	Sub-item	Reference
		- load adjuster vehicles	
		Ramps/Ladders - passenger ramps - manual - hydraulic - truck/cart mounted - baggage ramps - safety steps - gantries - servicing platforms	
	Accommodation	Vehicle/unit storage & maintenance Crew Accommodation	
	Facilities	Toilets Communication - ramp - UHF - to aircraft plug-in headsets - ear protectors - telephone connections - vehicle - UHF	
	Services	Power Water	
	Environment	Utility Finishes Efficiency Lighting	
FIXED MAINTENANCE FACILITIES	Function	Provide indoor facilities for major work to be done on aircraft and its components	
	Accommodation	Hangars Maintenance Bases - major overhaul & rebuild equipment	

Division: INTERFACE	Component: INBOUND FLOW

Element	Item	Sub-item	Reference
DEPLANING PASSENGERS	Domestic – Terminating	Baggage Claim Landside Transport (City Terminal Alternative)	
	– Transfer	Transfer check-in Departure Gate	
	International – Terminating	Inspection Baggage Claim /Customs Landside Transport (City Terminal Alternative)	
	– Transit	Transit check-in Transit Lounge Departure Gate	
	– Transfer (Domestic)	Inspection Baggage Claim /Customs Check-in Departure Gate	
DEPLANING BAGGAGE	Domestic – Terminating	Sorting/Storage Baggage Claim Landside Transport (City Terminal Alternative)	
	– Transfer	Sorting Departing Flight	
	International – Terminating	Sorting/Storage Baggage Claim/Customs Landside Transport	
	– Transit	Sorting Departing Flight	
	– Transfer (Domestic)	Sorting Baggage Claim/ Customs Check-in	

Division: INTERFACE	Component: INBOUND FLOW		
Element	**Item**	**Sub-item**	**Reference**
		Departing Flight	
DEPLANING CARGO	Domestic - Terminating	Reception/Sorting Pre-delivery Holding Delivery Area Landside Transport	
	- Transfer	Direct Apron OR Transfer Assembly Departing Flight	
	International - Terminating	Reception/Sorting Bonded Holding Customs Exam. OR Import Storage Customs Exam. Cleared Bonded Delivery Area OR Storage Area Delivery Area Landside Transport	
	- Transfer	Direct Apron OR Transfer Assembly OR Bonded Holding Transfer Assembly Departing Flight	

Division: INTERFACE	Component: OUTBOUND FLOW

Element	Item	Sub-item	Reference
ENPLANING PASSENGERS	Domestic		
	- Originating	Check-in Departure Gate	
	- Transfer	Departure Gate	
	International		
	- Originating	Check-in Customs (if required) Inspection (if required) Departure Gate	
	- Transit	Departure Gate	
ENPLANING BAGGAGE	Domestic		
	- Originating	Check-in Departing Flight	
	- Transfer	Departing Flight	
	International		
	- Originating	Check-in/Customs Departing Flight	
	- Transit	Departing Flight	
ENPLANING CARGO	Domestic		
	- Originating	Receiving/Processing Holding Area Load Assembly Waiting Area Departing Flight	
	- Transfer	Load Assembly Departing Flight	
	International		
	- Originating	Receiving/Processing Holding Area OR Export Storage Holding Area Load Assembly Waiting Area	

Division: INTERFACE	Component: OUTBOUND FLOW

Element	Item	Sub-item	Reference
		Departing Flight	
	- Transfer	Load Assembly Departing Flight	

Division: INTERFACE	Component: LOADING/UNLOADING		
Element	**Item**	**Sub-item**	**Reference**
PASSENGERS	Design Criteria	Maximum Efficiency Minimum Level Change Maximum Protection - weather - blast - noise - vehicles Flexible/Expansible	
	Flow Separation	Enplaning Deplaning International/Transit Domestic/Transfer	
	Systems	Loading Bridges - telescopic - radial Vehicular - buses - mobile lounges Pedestrian	
	Accommodation	Departure/Arrival Rooms	
	Facilities	Check-in Counter Seating Area Toilets Telephones Message Board	
	Services	P/A System - CCTV - Local - Master Airline Comms.	
	Environment	Comfort Oriented A/C as required Comfort Lighting Background Music Comfort Finishes	

Division: INTERFACE		Component: LOADING/UNLOADING	
Element	**Item**	**Sub-item**	**Reference**
BAGGAGE	Design Criteria	Maximum Efficiency Minimum Handling Minimum Control Maximum Flexibility	
	Flow Separation	Inbound Outbound International Domestic Transit Transfer Outsized/Oddshaped Breakdown Routing	
	Systems - Load/Unload	 Forklifts Container Belts Conveyor Belts Elevators Chutes Manual	
	- Conveyance	Container Dollies Container Belts Trucks Tractor Trains Carts Dollies Conveyor Belts Manual	
	Accommodation	Sorting Area Storage Area	
	Facilities	Sorting - automatic - manual Flow Control Storage - short-term - long-term - bonded - special	

Division: INTERFACE		Component: LOADING/UNLOADING	
Element	**Item**	**Sub-item**	**Reference**
		Office	
		Staff Toilets	
	Services	Airline Comms.	
		Flight Information	
		- P/A System	
		- CCTV	
	Environment	Efficiency Oriented	
		Protected Work Areas	
		Utility Lighting	
		Utility Finishes	

Division: INTERFACE	Component: LOADING/UNLOADING

Element	Item	Sub-item	Reference
CARGO	Design Criteria	Maximum Efficiency Minimum Handling Minimum Control Maximum Flexibility Expansion Possibility	
	Flow Separation	Inbound Outbound International Domestic Transit Transfer Heavy & Bulky Goods Special Cargo (Radio-Actives, Animals, Human Remains)	
	Systems - Load/Unload	Pallet Conveyors Belly Feed Conveyors Pre-Staging Craning Facilities Forklifts Container Belts Conveyor Belts Elevators Manual Container Acceptance/Discharge	
	- Conveyance	Belt and Roller Conveyors Heavy Duty Elevators Loading Vans Pallet Conveyors Stackers Trucks Forklifts Tractor Trains Carts - Dollies Manual	

Division: INTERFACE	Component: LOADING/UNLOADING

Element	Item	Sub-item	Reference
	Accommodation	Apron Handling Area Handling Area - Pallet Build-Up - Order Pickup - Bonded Storage Sorting Area Storage Area Offices Trucking Concourse Parking	
	Facilities	Sorting - Automatic - Manual Flow Control Airport Mail Air Freight Forwarder Air Express Storage - Short Term - Long Term - Bonded - Special	
	Services	Telephone P. A. Pneumatic Tubes Message Conveyors Teletype CCTV Ground Radio (Walkie Talkies)	
	Environment	Efficiency Oriented Protected Work Areas Utility Services	

Division: INTERFACE		Component: CIRCULATION	
Element	**Item**	**Sub-item**	**Reference**
PASSENGERS	Design Criteria	Minimum Distances Direct Routing Self-evident Routing Minimum Level Change Flexible/Expansible	
	Flow Separation	Enplaning Deplaning International/Transit Domestic/Transfer	
	Systems	Moving Walkways Minirails Escalators Elevators Pedestrian	
	Accommodation	Corridors Tunnels Enclosed Bridges Staircases Ramps	
	Facilities	Toilets Telephones Dispensers Drinking Fountains	
	Services	Information - P/A System - CCTV - Clocks Direction Indication Wheelchairs Baby Pushchairs Pushcarts	
	Environment	Movement Oriented A/C as required Subdued Lighting Background Music Min. Maint. Finishes	

Division: INTERFACE	Component: CIRCULATION

Element	Item	Sub-item	Reference
BAGGAGE	Design Criteria	Economic Justification Minimum Handling Operations Ability to Handle Variety of Sizes Ability to Handle Peak Loads Compatability With Electronic Check-In Systems Flexible/Expansible	
	Flow Separation	Inbound to - Domestic Claim - Storage - Customs Claim - City Terminal Outbound to - Loading Area Transit to - Loading Area Transfer to - Loading Area Breakdown Routing	
	Systems	Conveyors Containers Chutes Elevators Emergency/Manual - Carts - Trucks Handling Provision for special items	
	Accommodation	Storage	
	Facilities	Sorting Flow Control Telephone Intercomm	

Division: INTERFACE	Component: CIRCULATION

Element	Item	Sub-item	Reference
	Services	Telephone Intercomm	
	Environment	Efficiency Oriented Protected Work Areas Utility Services	

Division: INTERFACE	Component: CIRCULATION

Element	Item	Sub-item	Reference
CARGO	Design Criteria	Maximum Efficiency Economic Handling Short Direct Cargo Flow Flexibility/Expansibility	
	Flow Separation - Deplaning	Direct Apron Transfer Domestic - terminating - transfer International - terminating - transfer	
	- Enplaning	Domestic - terminating - transfer International - terminating - transfer	
	Systems	Receiving Conveyors Roller Conveyors Gravity Floor Storage Racks Towlines Loading Fingers Order Pickers Sorters - automatic - carousel Freight Belly Feed Conveyors	
	Accommodation	Export Receiving Area Import Delivery Area Sorting Area Stacking Area /Accumulation Piers Order Picker Area Pallet Buildup Area Special Storage - oversize/overweight - special cargo	

Division: INTERFACE	Component: CIRCULATION

Element	Item	Sub-item	Reference
		Customs & Appraisers Offices Building Services & Maintenance Cafeteria	
	Facilities/Services	Telephone Teletype P. A. - Intercomm CCTV Pneumatic Tubes Data Processing Systems	
	Services	Staff Toilets	
	Environment	Efficiency Oriented Utility Finishes	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
PASSENGERS	Design Criteria	Maximum Efficiency Self-evident Routing Minimum Controls Flexible/Expansible	
	Flow Function - Inbound	International Transfer/Transit	
	- Outbound	Domestic International Transfer/Transit	
	Systems - Inbound	International - Health Control - Passport Control - Customs Check Transfer/Transit - Check-in - (Pref. no controls)	
	- Outbound	Domestic/International - central check-in - gate check-in - split check-in International - Customs (if required) - Passport Control - Health (if required)	
	Accommodation - Inbound International	Arrival Lounges Processing Channels Waiting Rooms Health Exam. Rooms Hospital Area Doctors Offices Nurses Offices Inspection Rooms Detention Rooms Immigration Offices Security Offices	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
		Baggage Claim Customs Examination Search Rooms Customs Offices Bonded Store	
	- Inbound Transfer-Transit	Check-In Area	
	- Outbound Domestic	Check-in; Ticketing Waiting Room Immigration (if required) Gate Check-in	
	- Outbound International	Check-in; Ticketting Processing Channels Waiting Rooms Immigration (if required) Customs (if required) Health Exam Rooms Doctors - Nurses Offices Security Offices Baggage Storage	
	- Outbound Transfer-Transit	Check-in Area Waiting Room Lounges	
	- General	Lounges Concessions Post-office Rest Rooms	
	Facilities	Check-in counters Waiting Areas Lounges Rest Rooms Telephones Message Boards Direction Signs	
	Services	Telephone PA CCTV Airline Comms.	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
	Environment	Comfort Oriented - air conditioning - lighting - area finishes Background Music	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
BAGGAGE	Design Criteria	Maximum Efficiency Minimum Handling Minimum Control Flexibility/Expansibility	
	Flow Separation	Inbound/Outbound International/Domestic (Transit/Transfer) Outsized/Oddshaped Breakdown Routing (City Terminal	
	Systems Outbound	Domestic/International Check-in Weigh- In Tagging Facilities International Customs (If required)	
	Systems Inbound	International Claim Area Claim Equipment - conveyors - carousels Customs - inspection - search area	
	Accommodation	Outbound - buildup area Inbound - claim area - work space	
	Facilities	Flow Control Sorting Telephone Intercomm/PA	
	Services	Porters Self-tagging	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
	Environment	Efficiency Oriented Protected Areas Utility/Comfort Services	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
CARGO	Design Criteria	Maximum Efficiency Economic Handling Short Direct Flow of Cargo Flexibility/Expansibility	
	Flow Separation	Direct Apron Transfer Outbound - receiving & processing - storage - holding area - loading area - waiting area Inbound/Domestic - precheck-in holding area - check-in - pre-delivery holding area - delivery Inbound/International - precheck-in holding area - check-in - bonded holding area - storage - customs examination - cleared bonded area - delivery	
	Systems/Outbound	Receiving Weighing Sorting Labelling Backlog Load Build-up	
	Systems/Inbound	Receive Sort Truck Buildup Customer Pickup Truck Load Buildup Dispatch Inflight Transfer Load Buildup	

Division: INTERFACE	Component: PROCESSING FACILITIES

Element	Item	Sub-item	Reference
	Accommodation	Single/Multiple Occupancy Freight Handling Area Administration Area Personnel & Customer Accommodation Utility Services Storage for Handling Equipment Maintenance/Workshop A Areas	
	Facilities	Flow Control Data Processing Telephone PA – Intercomm Airline Comms	
	Services	Heating – Ventilation –A/C Humidity Control Utility Lighting Adequate power for handling systems Maintenance Fire Protection	
	Environment	Efficiency Oriented Utility Finishes Protected Areas	

Division: INTERFACE	Component: AIRLINE FUNCTIONALS

Element	Item	Sub-item	Reference
PASSENGER HANDLING	Design Criteria	Co-ordinate with Airlines - maximum efficiency - optimum space - flexible/expansible	
	Functional Flow	Inbound/Outbound International/Domestic Transit/Transfer VIP Passengers Invalids & Children	
	Systems	Check-In Flight Confirmation Wait Listing - Reservations Baggage Weigh-In Telephone Communication Intercomm Input to PA-CCTV Input to Message Boards Baggage Tagging/Identification Pneumatic Tubes	
	Accommodation	Ticketting/Check-In Baggage Sorting Pre-flight Storage Personnel Accommodation Rest Rooms	
	Facilities/Services	Information Counter Wheelchairs Baby Pushcarts Pushcarts	
	Environment	Efficiency Oriented	

Division: INTERFACE	Component: AIRLINE FUNCTIONALS

Element	Item	Sub-item	Reference
BAGGAGE HANDLING	Design Criteria	Coordinate with Airlines Economic Justification Minimum Handling Operations Peak Load Handling Capability Compatability with Electronic check-in systems Flexible/Expansible	
	Functional Flow	Inbound to - domestic claim - storage - customs claim - city terminal Outbound to - loading area Transit/Transfer to - loading area Breakdown Routing	
	Systems	Weigh-in Conveyors/Containers/Carousels Sorters Carts/Trucks Special Item Handling	
	Accommodation	Outbound - check-in buildup area - transit/transfer storage -loading area - storage for unaccompanied baggage - interline transfer storage area Inbound - receiving area - sorting area - claim area	

Division: INTERFACE	Component: AIRLINE FUNCTIONALS		
Element	**Item**	**Sub-item**	**Reference**
CARGO HANDLING	Design Criteria	Coordinate with Airlines - maximum efficiency - handling method - optimum space - cargo types - flexible/expansible	
	Functional Flow	Direct Apron Transfer Enplaning: - receive - weigh/sort - backlog - load buildup Deplaning - receive - sort - inflight transfer - customer pick-up - truck buildup - dispatch	
	Systems	Weighing Sorting - Automatic/ Carousel Labelling Conveyors Stackers Freight Belly Feed Conveyors Order Pickers	
	Accommodation	Export Receiving Area Import Delivery Area Sorting Area Stacking Area/Accumulation Piers Order Picker Area Special Storage - oversize/overweight - special cargo Customs & Appraisers	

Division: INTERFACE	Component: AIRLINE FUNCTIONALS

Element	Item	Sub-item	Reference
		Offices Building Services & Maintenance Cafeteria Employee Areas/Rest Rooms etc.	
	Facilities/Services	Data Processing Systems Telephone/Teletype Intercomm/PA CCTV Pneumatic Tubes Fire Protection Heating/Ventilation/AC Humidity Control Utility Lighting Adequate Power for Handling Systems Maintenance	
	Environment	Efficiency Oriented Utility Finishes Protected Areas	

Division: INTERFACE	Component: AIRLINE FUNCTIONALS		
Element	**Item**	**Sub-item**	**Reference**
OPERATIONS	Design Criteria	Co-ordinate with Airlines - maximum efficiency - optimum space - flexible/expansible	
	Functions	Operational Control Operational Trim Compilation of Aircraft Documents Co-ordination - functional flow - inspection controls Turnaround Servicing	
	Systems - Operational	Ticketing Reservations Flight Scheduling Flight Dispatch - briefing - flight planning Crew Routing Accounting & Payroll Catering	
	- Conveyance	Handling Sorting Processing - baggage - cargo - mail Aircraft Loading Apron Service Vehicles/ Equipment	
	- Turnaround Servicing	Unloading - passengers - baggage - cargo Galley Change Waste Tanks Water Tanks Cabin Cleaning Equipment Check	

Division: INTERFACE	Component: AIRLINE FUNCTIONALS

Element	Item	Sub-item	Reference
		Fuelling Loading	
	– Maintenance	Aircraft Service Vehicles Service Equipment Processing Equipment	
	Accommodation	Offices Staff – rest rooms/toilets – showers – changing/locker rooms – cafeteria/meal facilities – Ticket Counter/ reservations Air Crew Quarters Baggage Handling Area Baggage/Cargo Storage Area OR Area for Handling Top-up and Transfer Cargo Bonded Aircraft Bar and Commissary Storage Storage/Work Area for Servicing Equipment Apron Handling Area	
	Facilities/Services	Check-In Counter Baggage Handling Telephone Teletype Data Processing CCTV PA/Intercomm Message Boards Seating/Waiting Areas Rest Rooms	
	Environment	Comfort/Efficiency Oriented Functional Lighting Air Conditioning as Req'd	

Division: INTERFACE	Component: MANAGEMENT FUNCTIONALS

Element	Item	Sub-item	Reference
OPERATION/ADMINISTRATION	Design Criteria	International Specification	2.2
		Canadian Specification	3.1
		Coordinate with appropriate authorities	
		- maximum efficiency	
		- optimum space	
		- flexible/expansible	
	Functions	Air Traffic Control	
		Airport Management	
		Concessions	
	Systems		
	- Operational	Air Traffic Control	
		Navigational Aids	
		Landing Aids	
		Manoeuvering Area	
		Processing Controls	
		- passengers	
		- baggage	
		- cargo	
		Safety and Emergency	
		- aircraft operations	
		- public	
		Information Systems	
	- Administration	Airport Servicing	
		Airport Maintenance	
		Building Services	
		Concessions	
		See appropriate checklists:	
	Accommodation	- air traffic control	
	- Operational	- navigational aids	
		- landing aids	
		- safety and emergency	
		See appropriate checklists:	
	- Administration	- servicing and maintenance	
		Staff	
		- restrooms/toilets	
		- showers	
		- changing/locker rooms	
		- cafeteria/meal facilities	

Division: INTERFACE	Component: MANAGEMENT FUNCTIONALS

Element	Item	Sub-item	Reference
		Concessions - public dining facilities - cocktail lounges - kitchen or storage - shops, banking facilities - post office - conference rooms - hotel - entertainment agency - television and newsreel - theatre - place of worship - VIP rooms - "lost and found" counter and offices - sightseeing areas - press and public relations facilities	
	Facilities/Services	Public - waiting areas - toilets - lockers - changing rooms/showers - restrooms - nursery - information	
	Environment	Efficiency/Comfort oriented Air Conditioning as required Optimum Lighting Finishes According to Function	
BUILDING SERVICES	Design Criteria	Local Requirements/Practice - efficient - economical - practical - flexible - expansible	

Division: INTERFACE		Component: MANAGEMENT FUNCTIONALS	
Element	**Item**	**Sub-item**	**Reference**
	Functions	Environment Control – airconditioning – heating – lighting –(building acoustics)	
		Service Items – power – water supply – drainage/sewerage – fire protection	
	Systems – Mechanical	Air conditioning – all-air – air-water – all-water – refrigerant	
		Heating – all-air – water – electric – natural gas – steam	
		Water Supply – domestic cold water – domestic hot water – commercial use	
		Drainage/Sewerage – sanitary – storm – combined	
		Fire Protection – stand pipe – sprinkler – chemical – alarm system	
	– Electrical	Lighting – general lighting	

Division: INTERFACE	Component: MANAGEMENT FUNCTIONALS

Element	Item	Sub-item	Reference
		- special lighting - emergency lighting - receptacle outlets	
		Power - utility power - emergency power - standby/no-break - special requirements	
	Accommodation - Mechanical	Air Conditioning - refrigeration machinery - air handling equipment - cooling towers - duct shafts - ceiling spaces - automatic control centre	
		Heating - boiler room - fuel storage - pump room - pipe shafts - pipe spaces	
		Water Supply - pump room - meter room - pressure tanks - heating facilities - treatment facilities	
		Drainage/Sewerage - collection - pumping station - septic tanks - treatment facilities	
		Fire Protection - entrance facilities - pumping station - storage tanks	

Division: INTERFACE	Component: MANAGEMENT FUNCTIONALS

Element	Item	Sub-item	Reference
		- storage spaces - pipe spaces	
	- Electrical	Lighting - entrance requirement - transformer room - switch gear room - distribution rooms - distribution panels - emergency power unit - conduit space	
		Power - entrance requirements - transformer room - switchgear room - emergency power unit - distribution rooms - conduit space	
	Facilities/Services	Staff Areas - lunch room - locker room - washroom - showers	
		Maintenance areas Storage Areas Telephones Intercom System Control System	
	Environment	Function Oriented Air Conditioned as required Ventilation/Humidity Control Utility Lighting Min. Maintenance Finishes	
		Fire Protection Pest Control Pollution Control	

Division: LANDSIDE	Component: TRANSFER FUNCTIONALS

Element	Item	Sub-item	Reference
PASSENGERS/BAGGAGE	Design Criteria	International Specification	2.2
		Canadian Specification	3.1
		Other	4.5
		Self-evident Routing	
		Maximum Efficiency	
		Flexible/Expansible	
	Flow Separation	Arrivals	
		Departures	
		International/Domestic	
		Interline Transfer	
		To/From City Terminal	
		Automobile	
		- private	
		- rental	
		Buses/Taxis	
		Rapid Transit	
		VTOL/STOL	
	Systems	Kerbside Check-in	
		Self-tagging	
		Moving Walks/Conveyors	
		Electronic Identification	
		Porters	
		Parking/Delivery	
	Accommodation	Loading/Unloading Area	
	Facilities/Services	Toilets	
		Telephones	
		Baggage Lockers	
		Information	
		- p/a system	
		- CCTV	
		- clocks	
		Direction Indication	
		Wheelchairs	
		Baby Pushchairs	
		Pushcarts	
	Environment	Comfort/Efficiency Oriented	

Division: LANDSIDE	Component: TRANSFER FUNCTIONALS

Element	Item	Sub-item	Reference
		Air Conditioning as req'd. Accent Lighting Background Music	
CARGO	Design Criteria	International Specification Canadian Specification Other	2.2 3.1 4.5
	Flow Separation	Cargo/Mail Inbound/Outbound Domestic/International Trucks, Trailers/Cars Direct Transfer - rapid transit - VTOL/STOL	
	Systems	Loading/Unloading - ramps - dock levellers - forklifts, etc. - special - large/heavy Apron Access	
	Accommodation	Trucking Dock Car Parking - staff - customers Truck Parking (standby)	
	Facilities/Services	Toilets - staff - visitors Telephones	
	Environment	Functional/Utility	
AUTOMOBILES (BUSES)	Design Criteria	International Specification Canadian Specification Other	2.2 3.1 4.5

Division: LANDSIDE	Component: TRANSFER FUNCTIONALS

Element	Item	Sub-item	Reference
	Flow Separation	Arrivals/Departures International/Domestic Decentralised Modules Private Rental Taxis/Buses Airport Staff Airline Staff	
	Systems	Owner Parking Parking/Delivery Service (Automatic) Controls - rental - taxis - buses	
	Accommodation	Car Park - long term - short term - metered - multi-level - covered Service Station Rental Parking /Service Taxi Standby Parking Bus Standby Parking	
	Facilities/Services	Information - passengers - public Telephones Intercom - rental - taxis - buses Toilets Drinking Fountains Servicing/Maintenance - rental - taxis - buses	

Division: LANDSIDE	Component: TRANSFER FUNCTIONALS

Element	Item	Sub-item	Reference
	Environment	Functional/Utility	
RAPID TRANSIT	Design Criteria	International Specification Canadian Specification Other	
	Flow Separation	Arrivals/Departures Passengers/Baggage Processing - city terminal - airport	
	Systems	Tracked Trains Hovertrains Hovercraft	
	Accommodation	Terminal/Docking Area Standby/Maintenance Area Passengers/Baggage - waiting - loading/unloading Operation Control Staff/Crew	
	Facilities/Services	Toilets/Restrooms Telephones Baggage Lockers Information - public address - CCTV - direction indication Service/Maintenance Requirements	
	Environment	Comfort/Efficiency Oriented	
VTOL/STOL	Design Criteria	International Specification Canadian Specification Other	

Division: LANDSIDE	Component: TRANSFER FUNCTIONALS

Element	Item	Sub-item	Reference
	Flow Separation	Arrival/Departure Passengers/Baggage Processing - city terminal - airport	
	Systems	VTOL - helicopter - aircraft STOL aircraft Airspace Organisation Air Traffic Control Check-in/Transfer Load/Unload - passengers - baggage Staff/Crew	
	Accommodation	Manoeuvring Area Parking Ramps Service/Maintenance Air Traffic Control - combined with airport - separate (co-ordinated) Passengers/Baggage - waiting - processing	
	Facilities/Services	Air Traffic Control (as for Airside) Passengers - toilets - telephones - information Operations (as for Airside) Service/Maintenance Requirements	
	Environment	Comfort/Efficiency Oriented	

Division: LANDSIDE	Component: MANAGEMENT FUNCTIONALS

Element	Item	Sub-item	Reference
OPERATIONS	Design Criteria	International Specification Canadian Specification Other Co-ordinate with Operators - airlines - bus/taxi companies - auto rental agencies - rapid transit - VTOL/STOL operators Co-ordinate with Local Authorities	
	Function - Automobiles	Car Parking Control Bus/Taxi Control Auto Rental Control	
	- Rapid Transit	Movement Control/ Co-ordination	
	- VTOL/STOL	ATC/Co-ordination	
	Systems	Traffic Control - road systems - rapid transit - VTOL/STOL Communications Navigational Aids Landing Aids	
	Accommodation	Control Rooms Communications Rooms Staff - toilets - restrooms - changing rooms, etc.	
	Facilities/Services	Power - normal - emergency Telephones Intercom	

Division: LANDSIDE	Component: MANAGEMENT FUNCTIONALS

Element	Item	Sub-item	Reference
SERVICING/ MAINTENANCE	Environment	Efficiency Oriented	
	Design Criteria	International Specification Canadian Specification Other	
	Function Separation	Car Parks/Garages Load/Unload Facilities - automobiles - buses/taxis - rapid transit - VTOL/STOL Manoeuvring/Movement Areas - roads - docking areas - landing areas/equipment Power and Lighting Systems Drainage Systems	
	Systems	Mobile - sweepers - snowblowers - snowplows - water trucks - lighting maintenance Building Maintenance	
	Accommodation	Staff Vehicles - parking - servicing Materials Storage	
	Facilities/Services	Power Water Telephones Intercom	
	Environment	Functional/Utility Oriented	

Division: LANDSIDE	Component: LAND ROUTE CONNECTIONS

Element	Item	Sub-item	Reference
APPROACH AND SERVICE ROADS	Design Criteria	International Specification Canadian Specification Other Co-ordinate with Local Authorities	
	Function Separation	Arrivals/Departures Passengers Cargo Public Staff Servicing	
	Systems	Automobiles Buses Trucks/Trailers	
	Accommodation	Roads/Highways - underground - ground level - elevated	
	Facilities/Services	Traffic Control System Route Indication Lighting Drainage Telephone Accident Services	
	Environment	Efficiency Oriented	
RAPID TRANSIT	Design Criteria	International Specification Canadian Specification Other Co-ordinate with Local Authorities	
	Function Separation	Arrivals/Departures To/From City Centre To/From Other Centres	

Division: LANDSIDE	Component: LAND ROUTE CONNECTIONS

Element	Item	Sub-item	Reference
	Systems	Tracked Trains Hovertrains Hovercraft	
	Accommodation	Track Routes - underground - ground level - elevated Marine Routes (Hovercraft)	
	Facilities/Services	Traffic Control System Drainage Accident Services Navigation/Docking Aids	
	Environment	Efficiency Oriented	
	Design Criteria	International Specification Canadian Specification Other Co-ordinate with Operators Co-ordinate with Local Authorities	
VTOL/STOL	Function Separation	Arrivals/Departures To/From City Centre To/From Other Centres	
	Systems	VTOL - helicopters - aircraft STOL	
	Accommodations	Airspace Organisation Manoeuvring Area	
	Facilities/Services	Air Traffic Control Ground Services Navigation/Landing Aids Accident Services	

Division: LANDSIDE	Component: LAND ROUTE CONNECTIONS

Element	Item	Sub-item	Reference
	Environment	Efficiency Oriented	

CLASSIFICATION

3000

OUTLINE

In order to provide a guide for airport designers and a reasonable uniformity in airport facilities, design criteria have been established by ICAO and various national aviation authorities.

ICAO strives toward uniformity and safety on an international level, and ICAO standards apply to all contracting States. Design standards for landing facilities are related to a classification system using a letter code. Currently, the letters A to G are used according to basic runway length at sea level for standard atmospheric conditions. (ICAO Annex 14, Part II, Chapter 3). At the Fifth Air Navigation Conference of ICAO held in Montreal in November 1967, it was recommended that this runway reference code system be revised and the proposed revision is expected to be ratified in December 1968, together with the related amendments to design parameters. The revised code, A' to E', covers basic runway lengths from 2000 ft. (600 m). to 7000 ft. (2100 m) and over.

The FAA (U.S.A.) uses single words to classify airports according to function, divided broadly into the two categories of air carrier and general aviation. The air carrier category is classified into Local, Trunk, Continental and Intercontinental.

The DOT (Canada) classifies airports primarily according to function and for identification and administrative purposes into eight classes, namely Mainline,Auxiliary, Satellite, Local, Development, Remote, Seaplane, and Heliport. The Mainline airports are further subdivided into International, Trunk, and Feeder. Design criteria for geometrical standards for runways, taxiways and aprons are classified according to "Design Aircraft Designators" , and are correlated to the airport classification system.

Since the purpose of this Planning Guide is essentially the provision of broad guidelines, the classification system contained herein is general rather than particular in approach.

It is also an initial attempt to provide a basis for a classification system utilizing "level of service" as a means of categorizing airports by the application of appropriate determinants separately to Airside, Interface and Landside.

In such a system the classification of Airside would be according to a letter code from A to E, and similarly, Interface and Landside. When it forms part of a properly balanced air transportation system, an airport would classify as AAA or CCC, for example. In a system where development is unbalanced, an airport would classify, for example, as ABD or CBE. (The state of development would apply to the air transportation system and/or to the country as a whole).

In such a system the determinants for the Airside would involve primarily airport capacity rated in terms of annual operations qualified by peak IFR and/or peak VFR capacity according to location and meteorological conditions. Other classification determinants would include basic runway lengths (critical aircraft), airspace organization and route structures.

OUTLINE

The determinants for the Interface would involve primarily passenger/cargo handling capacity rated in terms of annual volumes qualified by peak hour capacity according to service type (International, Domestic). Other classification determinants would include critical aircraft and operator/carrier policies.

The determinants for the Landside would involve primarily passenger/cargo volumes and peak hour capacity qualified by the development status of the ground transportation systems (rapid transit, VTOL/STOL, automobile-oriented society rated above newly-emergent society, or post-industrial nations rated above pre-industrial nations).

Such a classification system would provide the basis for broad ranges of facility and equipment requirements and ranges of guideline time/cost estimates to assist in long-range general planning.

As stated previously, the classification system presented herein can be used as a basis for the system described above, but primarily it is intended to assist in the determination of general requirements and of a broad base for cost estimating of facilities.

The Airside rating is based on basic runway lengths, the Interface rating on passenger/(cargo) volumes, and the Landside on passenger/(cargo) volumes.

The updating of this Section will carry the system further towards a "level of service" system and it is expected that by then there will be improved methods for establishing capacity parameters and space standards.

APPLICATION - AIRSIDE

The prime objective of this sub-section, in its present initial form, is to provide a basis for determining broad requirements and estimates.

Since the establishment of capacity requirement forecasts requires in-depth study, and since the Planning Guide is intended essentially to provide those persons experienced in airport planning or construction with broad guidelines only, no attempt has been made herein to present a basis for determining runway/taxiway layout or overall runway/taxiway requirements.

Assuming that the potential client authority has an idea of expected growth rates and of the general order of magnitude of forecast requirements, a useful guide for assessing the potential size of the airside facilities required is the FAA Advisory Circular No. 150/5060 Bibliographical Ref. (9).

The classification by basic runway length used here is based on the recommendations of the Fifth Air Navigation Conference of ICAO. The minimum runway lengths (rated according to DOT Design Aircraft Designators and based on length at sea level for standard atmospheric conditions), provide an indication of length according to critical aircraft.

Account must be taken of the various factors which affect the determination of runway length, such as performance requirements (as imposed by the Government concerned, or by ICAO), the environment at the airport (temperature, surface winds, runway gradient, airport elevation), and the items which establish the operating take-off and landing gross weights of the critical aircraft (trip length, en route conditions, cruise altitude and speed). It should be noted that the combined effects of these factors can increase the runway length requirements up to 50% - Bibliographical Ref. (10). Consequently these factors need to be accounted for, if only in a general way, for even guideline estimates.

Assessment of Geometrical Standards can be determined from either Bibliog. Reference (11) or ICAO Annex 14 and Attachments.

For a rough estimation of the apron area requirements, two graphs are included, derived from the estimates contained in "Aviation Demand and Airport Facility Requirement Forecasts for Large Air Transportation Hubs through 1980" (FAA - August 1967).

The use of these graphs assumes that a rough idea is known of the potential annual enplaned passenger volumes and that some thought is given to the potential aircraft mix.

The"Analysis of Gate Requirements - Passenger Terminal" - indicates graphically the relationship of the numbers of gates required to the annual enplaned passenger volumes for 1966 and 1980 forecasts for the twenty-two metropolitan areas (Large Hubs) which were the subject of the above-mentioned FAA report. The 1966 scheduled gate position for a number of selected Large Hub locations were determined by comparing 1966 activity statistics on passenger enplanements with the gates required by schedules derived from a comparable edition datewise of the Official Airline Guide.

The relationships computed gave a base of 58,000 average annual enplanements per gate for "Terminal" locations and 68,000 for "En Route" locations. Categorization of terminal or en route location was based on a judgement determination according to geographical location and the relation of originations to enplanements. Large hubs averaged 91.5% originations to enplanements. Percentages above this indicated a terminal location, and below, an en route location.

The forecast requirements for 1980 were plotted graphically and the average forecast requirements calculated from the estimates provided for each hub. These indicate an average of 141,000 enplanements per gate for "Terminal" locations and 168,000 for "En Route" locations. (In the estimates produced by the FAA, the forecast total gates required per hub were corrected to allow for projected peak hour operations and the introduction of high capacity aircraft prior to 1980).

Dependent on geographical location, route structures and other factors, this graph can provide a guideline for relating gate requirements to annual enplaned passenger volumes and vice-versa.

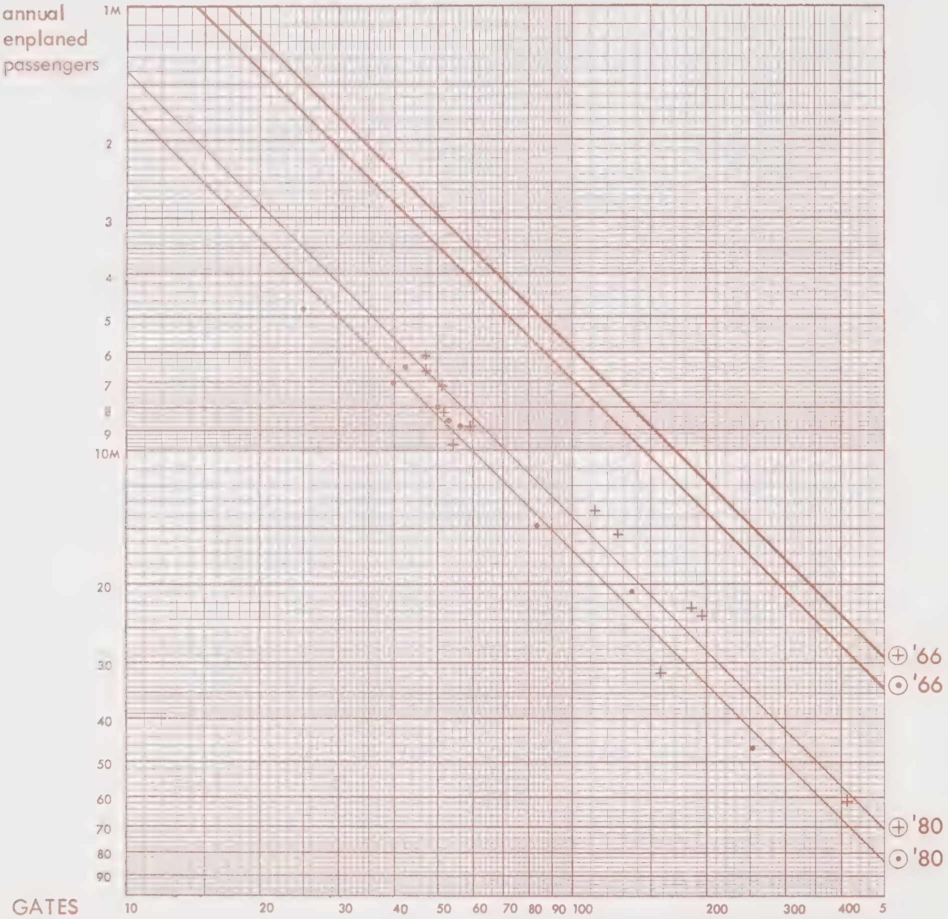
The "Calculation of Apron Area - Passenger Terminal" graph is based on the method applied in the above-mentioned FAA report. It provides a means of relating apron area to number of gates and aircraft mix. It should be noted that the aircraft mix percentages are related primarily to the introduction of large-capacity aircraft.

(The FAA report also contains methods for determining gate positions and apron area required for cargo terminals).

AIRSIDE

CLASS	ICAO RECOMMENDATION	DOT DESIGN AIRCRAFT DESIGNATORS		
	BASIC RUNWAY LENGTH	TYPICAL AIRCRAFT	TYPE	MINIMUM RUNWAY LENGTH
A	7000' and over (2100 m)	747 SST C5	A	10,000'
		DC8 (60 VC10 (super) 707 (cargo)	B	10,000'
		DC8 Vanguard Boeing 727 VC10 707	C	8,000'
		Hercules 130 DC9 (32) Electra	D	7,000'
B	5000' – 7000' (1500 m) – (2100 m)	DC 6B DC9 (14)	E	6,000'
		Viscount DC4 Gulfstream Jet Star	F	6,000'
		Dart Herald F 27	G	5,000'
C	3000' – 5000' (900 m) – (1500 m)	DC 3	H	4,000
D	2500' – 3000' (750 m) – (900 m)			
E	less than 2500'	Beach 18 King Air D.H. Dove Aztec	J	1,500

ANALYSIS OF GATE REQUIREMENTS - PASSENGER TERMINAL



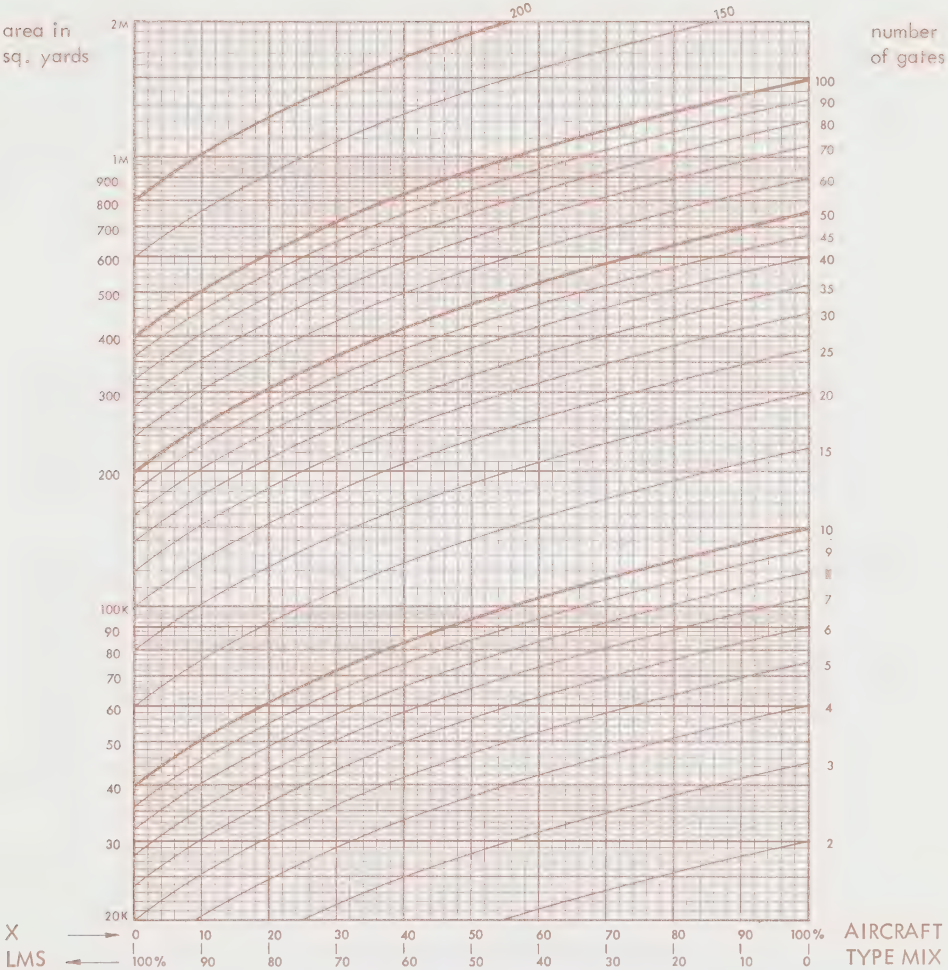
Sched gates 1966 from O.A.G.
"terminal" - av ann enpl 58,000/gate
"en route" - av ann enpl 68,000/gate
forecast gates 1980 corrected to
proj peak hr ops and for large
capacity aircraft

⊕ '66 = av sched gates 1966 - "terminal" locations
⊙ '66 = av sched gates 1966 - "en route" locations
+ = forecast gates 1980 major "terminal" hubs
• = forecast gates 1980 major "en route" hubs
⊕ '80 = av forecast gates 1980 major "terminal" hubs
⊙ '80 = av forecast gates 1980 major "en route" hubs

(based on system applied by FAA to determine "Aviation demand and airport facility requirement forecasts for large air transportation hubs through 1980")

K = thousands
M = millions

CALCULATION OF APRON AREA - PASSENGER TERMINAL



TYPE OF AIRCRAFT	APRON SPACE/AIRCRAFT (sq.yds.)
X - (over 200 seats)	15,000 = 15,000
L - (120-199 seats)	6,000
M - (75 - 119 seats)	4,000 = 4,000 average
S - (55 - 74 seats)	3,000

Areas allow for apron clearances but not for taxying

(based on system applied by FAA to determine "Aviation demand and airport facility requirement forecasts for large air transportation hubs through 1980")

K = thousands
M = millions

APPLICATION - INTERFACE

The basis of classification for the Interface contained in this sub-section is annual passenger volumes determined from annual enplaned passengers X 2, rated as follows:

A	more than		5,000,000
B	1,000,000	to	5,000,000
C	500,000	to	1,000,000
D	100,000	to	500,000
E	less than -		100,000

The system for the determination of typical peak hour passengers (TPHP) is that used by the FAA in establishing the facility requirement forecasts for large hubs through 1980 - Bibliographical Ref. (12). The methods have been tested by the FAA and the results checked against other available forecast data as to their validity. The results appear to be reasonable, and it is the intention that the methods be refined and updated as additional data becomes available.

It is recognized that systems for determining space allocation based on TPHP have considerable limitations and are not sufficiently accurate for rigid application during the concept development or detail design phases for passenger facilities. However, for determining the general order of magnitude of requirements, the system outlined herein is no doubt sufficiently accurate, provided the inherent weaknesses are recognized. A more accurate system is being developed, relating queueing theories and cost effectiveness to space requirements - and especially applicable to the decentralized linear module concept. When this system has been established and tested, it will provide a better basis for determining general requirements for broad band estimating.

The application of the system outlined herein is as follows:

1. Determine total annual passenger volumes for Domestic and International, separately:

Total annual volume-Domestic = annual enplaned Domestic passengers X 2

Total annual volume-International = annual enplaned International passengers X 2

2. From the "Derivation of TPHP" graph establish the Total TPHP by adding TPHP (Domestic) to TPHP (International) derived separately using the total annual passenger volumes determined above.

3. From the "Calculation of Passenger Facilities Space" graph establish the facility area in square feet.

NOTE: "Circulation, Utilities, Services, Conveniences" also includes Rest Rooms, Mechanical and Electrical Space, Maintenance Rooms, Walls and Partitions.

"Passenger Handling and Airline Operations" includes Ticket Lobby, Airline Operations, Baggage Claim Areas, and Waiting Rooms.

"Concessions" includes Eating Facilities, Kitchen and Storage and other concessions.

4. To determine Inspection Facilities space firstly derive International TPHP (d) from the annual enplaned International passenger volume applied to the "Derivation of TPHP" graph. (This assumes that the volume of deplaned passengers approximately equals the volume of enplaned passengers). Then establish the area requirements from the "Calculation of Inspection Facilities Space" graph.

NOTE: "Circulation, Utilities, Services, Conveniences" also includes Baggage Assembly, Walls and Partitions.

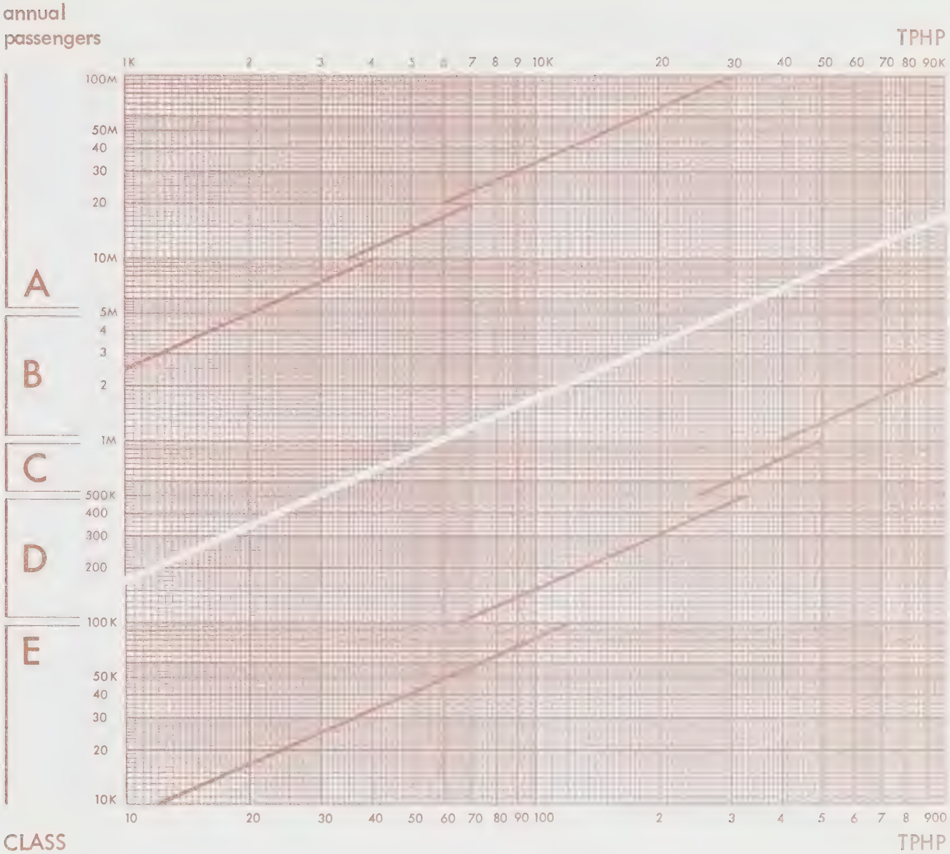
"Inspection Facilities" include Health, Immigration, Customs and Agriculture.

5. Where applicable (for combined Domestic and International facilities) the areas calculated from 3. and 4. can be added to give total gross area.

NOTE: The area calculations do not include for Airport Administration space, nor for air freight/cargo facilities.

A description of the system used by the FAA for the determination of cargo facilities space, together with useful data, is included.

DERIVATION OF TPHP



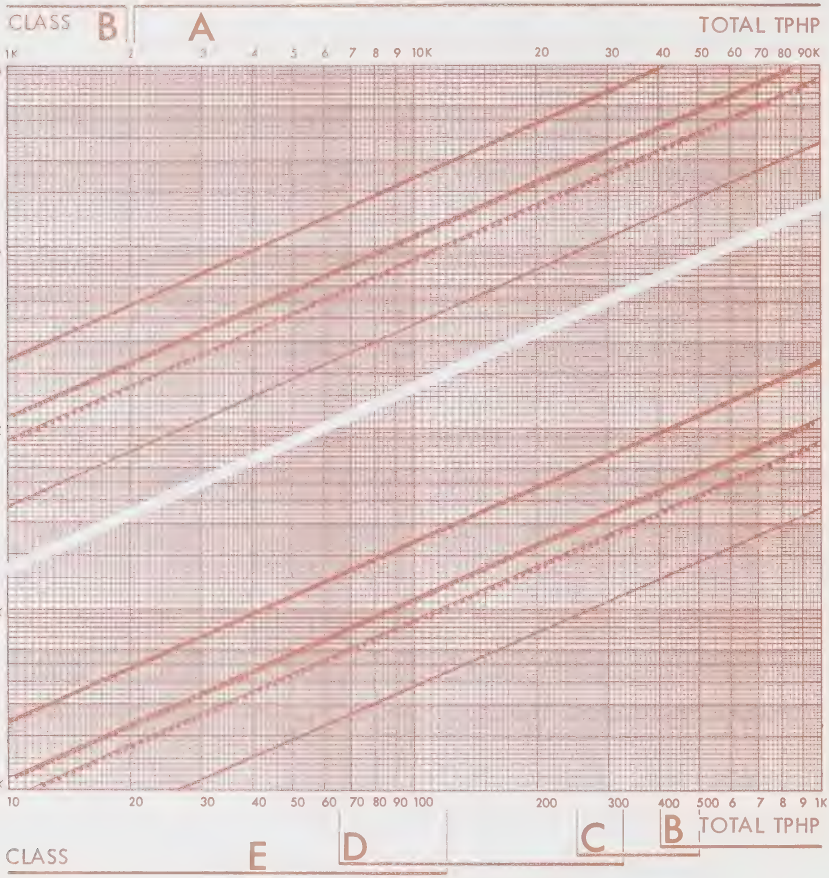
ANNUAL PASSENGERS			TPHP %
20M	and	over	.030
10M	to	19.9M	.035
1M	to	9.9M	.040
500K	to	999.9K	.050
100K	to	499.9K	.060
less than		100.0K	.120

These values apply separately to domestic and international passengers at any given location

K = thousands
M = millions

(based on system applied by FAA to determine "Aviation demand and airport facility requirement forecasts for large air transportation hubs through 1980")

CALCULATION OF PASSENGER FACILITIES SPACE



Use TOTAL TPHP = TPHP (INTL) + TPHP (DOM)
where TPHP (INTL) derived from Ann Intl Enpl x 2
and TPHP (DOM) derived from Ann Dom Enpl x 2
calculated separately on "Derivation of TPHP" graph

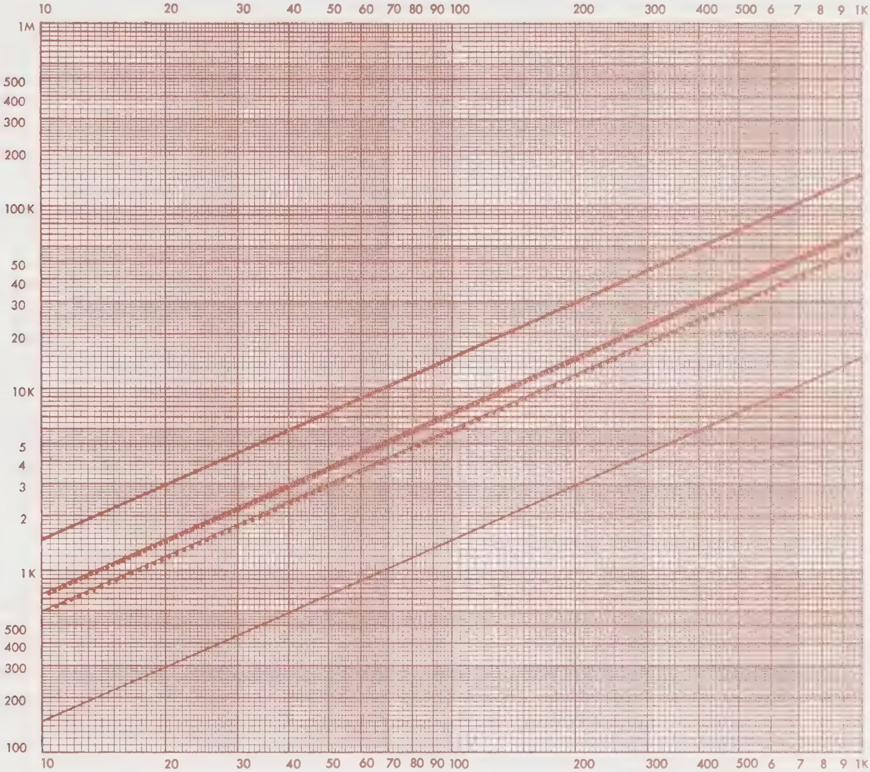
NOTE: GUIDE ESTIMATES ONLY -
does not allow for queueing theory

= Gross Area
= Circulation, Utilities Services, Conveniences
= Passenger Handling and Airline Operations
= Concessions
Admin. and Inspection not included

(based on system applied by FAA to determine "Aviation demand and airport facility requirement forecasts for large air transportation hubs through 1980")

K = thousands
M = millions

CALCULATION OF INSPECTION FACILITIES SPACE



INTL TPHP (d) = TPHP Deplaned
derived from Ann Intl Enplaned
(assuming Deplaned = Enplaned)
calculated on "Derivation of TPHP" graph

= Gross Area
= Circulation, Utilities Services, Conveniences
= Inspection Facilities
= Visitor Waiting

Add to "Passenger Facilities" to give Terminal Space excluding Airport Administration

NOTE: GUIDE ESTIMATES ONLY - does not allow for queueing theory

(based on system applied by FAA to determine "Aviation demand and airport facility requirement forecasts for large air transportation hubs through 1980")

K = thousands
M = millions

CALCULATION OF CARGO FACILITIES SPACE REQUIREMENTS

Data derived from system used by FAA - Bibliographical Reference (12).

1. From an analysis of hypothetical cargo loads covering a range of packaged densities, compared with the average pallet (or container) areas for B-747, L-500, DC-8-60 series and 1967 aircraft, the following basis was derived and used.

   - Space required for Peak Load handling = 30 sq.ft./ton.

2. Incorporating area calculations used for determining normal processing space, plus 25% for deferred freight, the following basis was used:

   - Space required for Normal plus Deferred Load handling (including circulation, separate space for various destinations, and equipment space) = 83.4 sq.ft./ton (per day).

3. • Administrative Area = 5% to 15% of total terminal space (Factor used -7%).

4. In order to approximate peak period cargo, the peak period gates must be multiplied by an average aircraft load. For forecasting cargo building space, the following assumption, based on cargo weights for B-747, L-500, DC-8-63 and 1967 Aircraft adjusted for numbers in fleet and 80% load factor, was used:

   - Average Aircraft Load = 76.5 tons.

The total Cargo Facilities Building space is estimated as follows:

5. • Space required for handling Peak Cargo (sq.ft.) = Total All-Cargo Gates Peak Period X 76.5 tons X 30 sq.ft./ton.

6. • Space required for Normal and Deferred Freight, Circulation, etc. (sq.ft.)
   $= \dfrac{\text{Annual Tons}}{\text{264 working days}} \times 83.4$ sq.ft./ton.

7. • Administrative Space = 7% of Item 5 + Item 6.

8. • Total Cargo Facility Space = Item 5 + Item 6 + Item 7.

APPLICATION - LANDSIDE

The basis of classification for Landside is annual passenger volumes determined from annual enplaned passengers X 2, rated as follows:

A	more than		5,000,000
B	1,000,000	to	5,000,000
C	500,000	to	1,000,000
D	100,000	to	500,000
E	less than -		100,000

For the initial purposes of the Planning Guide, the Landside sub-section covers basically the area required for vehicular parking for passenger facilities, and vehicular loading area for cargo facilities.

The updating process will extend this to cover the other requirements covered by the sub-system to integrate the total airport system with the ground transportation system. These other requirements will include the airport approach road system and the facilities for such ground transport systems as rapid transit, hovertrain, and VTOL/STOL where applicable.

A brief description of the system used by the FAA for determining the 1980 Large Hub requirements is included.

It should be noted that the basis indicated for calculation of vehicular parking spaces (TPHP X 1.5) is applicable to a highly-developed automobile-oriented society, and a judgment decision needs to be made adjusting this factor according to the particular situation. The area factor should also be adjusted where vehicles are smaller than those manufactured in North America.

SPACE REQUIREMENTS - VEHICULAR PARKING AND CARGO VEHICULAR LOADING

Data and system used by FAA - Bibliographical Reference (12)

1. • Vehicular Parking Spaces (Passenger Facility) = Total TPHP X 1.5

2. • Area of Parking Facility (square yards) = Item 1 X 35.5

3. For determining an approximation of cargo vehicular loading requirements the present nominal assumption based on efficiency of truck dock operations is 5,000 lbs/hour. Taking into account the expected increase in efficiency due to computerization, automation, etc, the basis used for 1980 by the FAA is:

   • Truck Dock Operation = 10,000 lbs/hour.

4. On the basis that Daily Tons = $\frac{\text{Annual Tons}}{\text{264 working days}}$ then the following calculation was applied:

   • Total Number of Truck Docks = $\frac{\text{Daily Tons x 2,000 (lbs/ton)}}{\text{24 (hours/day) x 10,000 (lbs/hour)}}$

5. Incorporating area required for docking and manoeuvring (12' x 50' x 2) the basis used is:

   • Space for Truck Docks (square yards) = Item 4 x 133.

COST ESTIMATES

4000

OUTLINE

The cost estimates contained in this Section are based on figures supplied by the Department of Transport.

It is important to note that the costs indicated are Canadian dollars (1967) and for equipment they are mostly rough estimates f.o.b. eastern Canada.

For these to be used as a basis for project guideline estimates, many factors need to be taken into account, depending on type and size of project, geographical location, etc., including the following:

- shipping costs
- local customs, excise and sales taxes
- brokerage/agent charges
- customs relief policies (government clients)
- local labour/materials costing indices
- local installation cost indices
- effects of local practices (construction, etc.)
- local laws - company tax, income tax, incorporation, immigration (resident installation/supervision staff) import/export, construction byelaws
- local conditions (meteorological, geological, transportation services, etc.)
- financing costs and administration
- operation and maintenance costs.

A system outlining a basis for cost estimates for runways, taxiways and aprons is included. It is proposed that data input to this system be provided for updating the Planning Guide.

The outline estimating system proposed for Facilities utilises the Elemental Method of Cost Analysis. This method was evolved by the Ministry of Education in Great Britain during the immediate post-war period and was originally intended to be applied to educational buildings. As a result of the work of cost research groups in the Royal Institute of British Architects and the Royal Institute of Chartered Surveyors, the method is now used extensively for preliminary estimates and cost planning on all types of projects.

The objectives of the method are described as follows:

1. To reveal the distribution of costs between the constituent elements of a building.
2. To relate the cost of any constituent element to its importance as a necessary part of the whole building.
3. To compare the cost of the same element in different buildings.
4. To discover how costs could have been allocated to obtain a better building.
5. To obtain and use cost data in planning other projects.

OUTLINE

The prime importance of the development of such a system is that a basis is provided for the retention of information on past projects in such a manner that it is available for estimates on future projects and, more important, in such a manner that it can be used for cost planning - a means of controlling costs.

The Elemental method uses a breakdown consisting of functional elements, where a functional element is defined as that part of a building which more or less always performs the same function irrespective of its construction.

The costs are distributed over all the elements and each element can be analysed in two ways.

Firstly, they can be shown as a cost per square foot of the gross area. For example, a building costing $21.00/sq.ft. may have the element "Floor Finishes" worth$0.71, "Ceiling Finishes" worth $0.90, and so on, with all the elements adding up to $21.00.

Then costs per square foot meet the objectives described earlier, and the cost per square foot of the gross floor area of the elements can be used for preliminary estimates, based on the theory that it is easier to estimate the parts than it is to estimate the whole.

Secondly, for more accurate estimates, further information can be provided, where the actual area of an element can be provided. For example, with the element "Walls above ground", exterior walls can be measured, and a unit rate per square foot of wall area can be calculated. The following information can then be provided:

1. The total cost allocated to the element;
2. The cost per square foot of the gross floor area that this cost represents;
3. The actual area of the element;
4. The cost per square foot of the actual area that the total cost of the element represents.

When preparing the cost analysis Item 2 is obtained by dividing the total gross floor area into Item 1, and Item 4 is obtained by dividing Item 3 into Item 1.

The application of this method required the retention and availability of reliable cost information in a uniform manner. The method is easily adaptable to computer processing and to design methods utilising modular co-ordination.

The checklists for "Facilities" contained in this Section outline the functional elements, and application of the method would presume the development of a "level of service" classification system wherein elemental costs are affected also by qualitative factors.

The determination of a guideline estimate would result from the summation of the "Total" costs of of the elements. ("Total" elemental cost = gross floor area x elemental cost/sq.ft.)

OUTLINE

It is expected that further data input to the Cost Estimates Section will be provided during annual updating of the Planning Guide.

Other items the costs of which need to be considered when providing guideline estimates include the following:

- land
- site development
- consulting fees
  - master planning
  - architectural
  - engineering
  - development consultants
  - legal
  - land surveyor
  - underwriter
- leasing costs
- soil tests
- interim financing
- local authority charges
- tenant inducements
- contingencies

Before the full economic feasibility can be determined, in-depth studies should be carried out including projected operating and maintenance costs.

Where projects overseas may involve Canadian External Aid, the general procedures to be followed by countries seeking assistance from the Canadian Government, under the aid programme, has been outlined by the External Aid Office as follows:

1. The Ministry responsible for the development of airfields within the country concerned approaches the Planning agency of his country with a proposal to build an airfield or related works.

2. The Planning agency checks the proposal to determine whether the project should be accorded priority in the list of projects for which aid applications are to be made.

3. When the Government of the country concerned decides to make an approach for aid, it is made to the Canadian Mission or to the External Aid Office, with a request that Canada should consider the project for grant or loan funds.

4. The country concerned is asked to prepare an official request for Canada to undertake the project, in accordance with the External Aid Office document "Guide for Preparing Proposal for Capital Projects" or, if technical assistance is required

in connection with airfield operating personnel, the request should be prepared in accordance with "Guide for Preparing Proposal for Technical Assistance".

5. The official request in four copies, including all annexes, and as much supporting data as the local agencies can provide, is returned to the External Aid Office, together with the Canadian Mission's assessment of the project.

6. The project is examined and if conditions appear favourable, a decision is taken to send a reconnaissance team to the site (usually from the Department of Transport) and a preliminary report is made to the External Aid Office.

7. In the light of this additional information and having regard to budgets, priorities and other factors, Canada decides whether or not to support the project.

8. If support is decided upon, the appropriate inter-governmental agreements are drawn up outlining the conditions of the grant or loan and delineating the responsibilities of both Canada and the local government in undertaking the project.

9. If consulting services are required, proposals are called from a list of suitably qualified consultants who have registered their interest with the External Aid Office by presenting full credentials and completing the Professional Record Forms which are obtainable from the Capital Assistance Division of External Aid Office.

10. When designs are completed, contracts are let by public tender called on behalf of the External Aid Office, either by the Department of Transport or the consultant.

Periodic press releases and news bulletins carry the announcements on the External Aid Office's policy statements and in respect of specific projects. Requests to be placed on the circulation list for such releases should be sent to the Director of Information, External Aid Office, Fuller Building, 75 Albert Street, Ottawa 4, Ontario.

Division: AIRSIDE	Component: AIR TRAFFIC CONTROL

Element / Item		Eqpt.	Inst.	Total
				$Can 1967
COMMUNICATIONS				
ATC Control System		10,000	4,000	14,000
ATC Position (per position)		2,500	500	3,000
Aeradio Control System Aeradio Position (one position)	))	10,000	5,000	15,000
Recorders		5,000	250	5,250
VHF – Transmitters		3,000	500	3,500
– Receivers		1,000	200	1,200
– Antennae		125	75	200
HF – Transmitters		10,000	500	10,500
– Receivers		1,000	200	1,200
UHF – Transmitters		3,000	300	3,300
– Receivers		1,000	250	1,250
– Antennae		125	75	200
LF – Transmitters		10,000	1,000	11,000
Time Insertion Units		3,000	500	3,500
Auto Terminal Information System		8,000	500	8,500
Trans Weather BISST		25,000	1,000	26,000
Back-Up – VHF – Transmitters		600	200	800
– Receivers		900	200	1,100
– Antennae		100	50	150
UHF – Transmitter		1,000	250	1,250
– Receivers		1,000	250	1,250
– Antennae		125	75	200
Remote Transmitter Building	approx. $25/-/sq.ft.			
Remote Receiver Building	approx. $25/-/sq.ft.			

Division: AIRSIDE	Component: METEOROLOGICAL SYSTEMS

Element / Item	Eqpt.	Instal.	Total
			$Can 1967
OBSERVATION SYSTEMS EQUIPMENT			
Ceiling			
- Ceilometers	15,000	10,000	25,000
Measuring Equipment for:			
Upper Air			
Wind			
Atmospheric Pressure			
Precipitation			
Temperature			
Humidity			
Visibility			
- Transmissometer	6,000)	3,000	16,500
- RVR Computer (ex. 3 readouts)	7,500)		
Ozone			
Radiation			
Seismic			
Sunshine			
Satellite			
- APT Weather Satellite Picture Receiving Station			
Radar			
- C-Band: 500 kw peak power	180,000	100,000	280,000
- X-Band:	100,000	60,000	160,000
- Weather Radar Analysers			

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element / Item	Eqpt.	Instal.	Total
			$Can 1967
LONG RANGE			
N.D.B. - High Power			
- Equipment Cost	25,000		
- Building Cost	15,000 to 30,000		70,000 to 95,000
- Site Works & Installation		30,000 to 40,000	
CONSOL			
LORAN			
DECCA-DECTRA			

Division: AIRSIDE	Component: NAVIGATIONAL AIDS		
Element / Item	**Eqpt.**	**Instal.**	**Total**
			$Can 1967
SHORT RANGE			
Distance Measuring Equipment	20,000		
VOR	25,000		
Radio Range - LF - MF			
TACAN			
VORTAC			

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element / Item	Eqpt.	Instal.	Total
			$Can 1967
RADIO BEACONS			
N.D.B. - Low Power			
- Equipment Cost	15,000		
- Building Cost	15,000 to 30,000		35,000 to 60,000
- Site Works & Installation		5,000 to 15,000	
En Route VHR Marker Beacons			
- Fan Marker			
- Z Marker			

Division: AIRSIDE	Component: NAVIGATIONAL AIDS

Element / Item	Eqpt.	Instal.	Total
			$Can 1967
RADAR			
AASR-1: L-Band, 500 KW peak power	450,000	90,000	540,000
ASR-5· S-Band, 500 KW peak power	400,000	80,000	480,000
SSR-	200,000)	50,000	300,000
- Side Lobe Suppression - SLS	50,000)		
Radar Bright Display Equipment	25,000		
Radar Video Map Generator	20,000		
ASDE			

Division: AIRSIDE	Component: LANDING AIDS

Element / Item			Total
			$Can 1967
LIGHTING AIDS			
- Runway Identification Lights (R.I.L.)			12,000
- Visual Approach Slope Indicator System (VASIS)			
i) First Installation			25,000
ii) Additional Installation			18,000
- Approach - High Intensity			
i) Category I - (including superimposed simple approach lighting system)			90,000
ii) or - if in addition to another high intensity approach lighting system			60,000
iii) Category II - (including superimposed simple approach lighting system).			115,000
iv) or - if in addition to another high intensity approach lighting system			85,000
- Approach - Low Intensity For standard 3000 ft. long simple approach lighting system			20,000
- High Intensity Touch Down Zone and Centreline Lighting			310,000
- Edge Lighting - High Intensity $4.50 per lineal foot of runway plus $18,000 for the first 6,000 ft. and an additional $18,000 for lengths in excess of 6,000 ft. up to a maximum of 12,000 ft.			
- Edge Lighting - Medium Intensity $4.00 per lineal foot of runway plus $4,000 for a site without high intensity lighting or plus $15,000 for a site with high intensity lighting			

Division: AIRSIDE	Component: LANDING AIDS		
Element / Item	**Eqpt.**	**Inst.**	**Total**
		(incl.*)	$Can 1967
NON-VISUAL/INSTRUMENT LANDING SYSTEMS (I.L.S.)			
A. Category 1 ILS			
i) Typical site development*, building,* and installation costs, including power and control, Assuming that airport standby power plant is available.			
- Localizer		40,000	
- Glide Path		40,000	
- Middle Marker		15,000	
- Outer Marker		25,000	
- Back Beam Marker		25,000	
		145,000	
ii) Dual System - including dual localizers, dual glide paths, 3 dual markers (middle, outer, back beam) associated remote control equipment and normal antennae.	150,000		295,000
iii) Single System - including single localizers, single glide paths, 3 single markers, associated remote control equipment and normal antennae.	100,000		245,000
Note 1: If special antennae are required, costs would be increased as follows:			
a) Cost of 165 foot dipole localizer array (not available from Canada)			40,000
b) Cost of 104 foot waveguide glide path antennae (not available from Canada).			60,000
Note 2: If the dipole localizer array is necessary and if a back course is required, a localizer at the reciprocal end of the runway will have to be included, (normal antennae - single equipment)			40,000
B. Category 2 and 3			
i) Typical site development*, building,* and installation costs, including power and control. Assuming that airport standby power plant is available.			
- Localizer		60,000	
- Glide Path		60,000	
- Inner Marker		10,000	
- Middle Marker		15,000	
- Outer Marker		25,000	
		170,000	

Division: AIRSIDE	Component: LANDING AIDS

Element / Item	Eqpt.	Inst.	Total
			$Can 1967
ii) Dual system – solid state equipment including dual localizers, dual glide paths, 3 dual markers (inner, middle, outer) associated remote control equipment, no-break standby power, and normal antennae	200,000		370,000
Note 3: Same comments apply as Category 1 Note 4: Full reversion capabilities will require additional equipment. Additional equipment may also be required to fulfill certain Category 3 requirements which are not now foreseen. Equipment for reversion capabilities will cost an estimated $50,000.			
C. Ground Check Equipment			
i) Extendible Mast (Clark Mast) including receivers	15,000		
ii) Portable Course Detector	3,000		
D. Flight Check Equipment			
i) Infra-red tracker (including telemetry system)	100,000		
ii) Airborne receivers, recorders, control equipment	40,000		
iii) Analog-to-Digital Converters	10,000		
iv) Airborne computer – for analyzing flight check in real time	50,000		
v) Gyro stabilized source for intra-red tracker	15,000		
E. Calibration Equipment			
i) ILS signal generator	7,000		
ii) O ddm calibrator	25,000		
iii) Test Bench	5,000		
F. Spares and Special Test Jigs – 20%			

Division: AIRSIDE	Component: MANOEUVRING AREA

Element / Item		A	B	C	D	E
RUNWAYS - COSTS PER 1000'	X	200' wide	150' wide	100' wide	75' wide	75' wide
Max. Gross Wt. (Kips) / Tire Pressure (PSI)		500 / 275	106 / 105	27 / 50	27 / 50	27 / 50
Foundations:						
Soils Factor	1					
	2					
	3					
	4					
	5					
Flexible Pavement:						
Foundation Type	1					
	2					
	3					
	4					
	5					
Rigid Pavement:						
Foundation Type	1					
	2					
	3					
	4					
	5					
Costs = $ Can. 1967						

Division: AIRSIDE	Component: MANOEUVRING AREA

Element / Item	A	B	C	D	E
TAXIWAYS - COSTS PER 1000' X	75' wide	75' wide	50' wide	50' wide	30' wide
Max. Gross Wt. (Kips) / Tire Pressure (PSI)	500 / 275	106 / 105	27 / 50	27 / 50	27 / 50
Foundations:					
Soils Factor 1					
2					
3					
4					
5					
Flexible Pavement:					
Foundation Type 1					
2					
3					
4					
5					
Rigid Pavement:					
Foundation Type 1					
2					
3					
4					
5					
Costs = $ Can. 1967					

Division: AIRSIDE	Component: MANOEUVRING AREA

Element / Item	A	B	C	D	E
APRONS - COSTS PER 1000 Sq. Yds.					
Max. Gross Wt. (Kips) / Tire Pressure (PSI)	500 / 275	106 / 105	27 / 50	27 / 50	27 / 50
Foundations:					
Soils Factor 1					
2					
3					
4					
5					
Flexible Pavement:					
Foundation Type 1					
2					
3					
4					
5					
Rigid Pavement:					
Foundation Type 1					
2					
3					
4					
5					
Costs = $ Can. 1967					

Division: AIRSIDE	Component: AIRPORT SERVICING & MAINT.

Element / Item			Cost/Unit
			$Can 1967
RUNWAY CLEARANCE			
Snow Plow			
Snow Blower			
Snow Sweeper			
CABASS Machine			
Sanding Machine			

Division: AIRSIDE	Component: SAFETY & EMERGENCY

Element / Item			Cost/Unit
			$Can 1967
FIRE SERVICES			
Fire Trucks			
- Hook			
- Ladder			
- Pumper			
Foam Trucks			
- Large			
- Small			
Water Truck			
CRASH SERVICES			
Rescue Trucks			
Rough Terrain Vehicles			
- Tracked			
- Wheeled			
Ambulance			
Nurse Truck			

Division: INTERFACE	Component: PASSENGER FACILITIES

Element / Item	A	B	C	D	E
$/sq.ft. of Gross Floor Area-Can.$ 1967	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.
SUBSTRUCTURE					
Normal Foundations					
Basement					
Special Foundations					
HORIZONTAL STRUCT. ELEMENTS					
Floors on Grade (incl. frame)					
Suspended Floors (incl. frame)					
Roof Construction (incl. frame					
Roof Finish					
EXTERIOR CLADDING					
Walls below ground (incl. frame)					
Walls above ground (incl. frame)					
Windows					
Exterior Doors					
Entrances and screens					
Projections, balconies, etc.					
INTERIOR VERTICAL ELEMENTS					
Permanent partitions and doors					
Movable partitions and doors					
Glazed partitions and doors					
MULTI-STOREY ELEMENTS					
Stairs, steps and ladders					
Elevators, dumbwaiters, hoists					
Escalators					
Chutes					
Pneumatic tubes					
Catwalks					
Moving floors and ramps					
Baggage conveyor systems					
INTERIOR FINISHES					
Floor finishes					
Ceiling finishes					
Wall finishes					
Special finishes					

Division: INTERFACE	Component: PASSENGER FACILITIES

Element / Item	A	B	C	D	E
$/sq.ft. of Gross Floor Area $ Can. 1967	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.
FITTINGS, FIXTURES, SPECIAL EQPT.					
Fittings and fixtures					
Special equipment					
Information systems					
– display system					
– public address system					
– closed circuit television					
ELECTRICAL					
PLUMBING AND DRAINS					
HEATING, VENTILATING, AIR CONDITIONING					
ALLOWANCES					
Hardware					
Contingencies					
Special allowances					
EXTERNAL WORKS					
DEMOLITIONS AND ALTERNATIONS					
INDIRECT AND SITE EXPENSES					

Division: INTERFACE	Component: CARGO FACILITIES

Element / Item	A	B	C	D	E
$/sq.ft. of Gross Floor Area $ Can. 1967	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.
SUBSTRUCTURE					
Normal Foundations					
Basement					
Special Foundations					
HORIZONTAL STRUCT. ELEMENTS					
Floors on Grade (incl. frame)					
Suspended Floors (incl. frame)					
Roof Construction (incl. frame)					
Roof Finish					
EXTERIOR CLADDING					
Walls below ground (incl. frame)					
Walls above ground (incl. frame)					
Windows					
Exterior Doors					
Entrances and Screens					
Projections, hoods, etc.					
INTERIOR VERTICAL ELEMENTS					
Permanent partitions and doors					
Movable partitions and doors					
Glazed partitions and doors					
MULTI-STOREY ELEMENTS					
Stairs, steps and ladders					
Elevators, hoists					
Conveyor systems					
Loading/unloading systems					
Stacking/sorting systems					
INTERIOR FINISHES					
Floor finishes					
Ceiling finishes					
Wall finishes					
Special finishes					
FITTINGS, FIXTURES, SPECIAL EQPT.					
Fittings and fixtures					
Special equipment					

Division: INTERFACE	Component: CARGO FACILITIES

Element / Item	A	B	C	D	E
$/sq.ft. of Gross Floor Area–$ Can. 1967	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.	$/sq.ft.
ELECTRICAL					
PLUMBING AND DRAINS					
HEATING, VENTILATING, AIR CONDITIONING					
ALLOWANCES					
Hardware					
Contingencies					
Special Allowances					
EXTERNAL WORKS					
DEMOLITIONS AND ALTERATIONS					
INDIRECT AND SITE EXPENSES					

Division: LANDSIDE	Component: TRANSFER FACILITIES

Element / Item

AUTOMOBILES			
Car Park			
- foundations			
- flexible pavement			
- rigid pavement			
- lighting			
Multi-level Structure			
RAPID TRANSIT			
Tracked and Hovertrain			
- terminal facilities			
- permanent way			
Hovercraft			
- terminal/docking facilities			
- navigational/docking aids			
VTOL/STOL			
Terminal Facilities			
Manoeuvring Area			
- foundations			
- flexible pavement			
- rigid pavement			
Navigational Aids			
Landing Aids			

Division: LANDSIDE	Component: LAND ROUTE CONNECTIONS

Element / Item

AUTOMOBILES			
Approach/Service Roads			
- foundations			
- flexible pavement			
- rigid pavement			
- lighting			
Overpasses			
RAPID TRANSIT			
Tracked and Hovertrains			
- permanent way			
- underground			
Hovercraft			
- navigational aids			
VTOL/STOL			
Air Space Organisation			
- air traffic control			
- navigational aids			

airports for export from canada

planning guide

Volume 2

CONTENTS

SECTIONS

SUB-SECTIONS

CANADIAN AIRPORTS ANALYSIS

5000

OUTLINE

This section presents a simple analysis of a selection of twelve Canadian airports. The analysis is based on the material prepared and compiled by the Master Plans Section of the Department of Transport. Its prime purpose is to provide an indication of facilities existing at these airports and to give an indication of costs.

The statistics and information provided are as at the dates when the information was compiled by the Department of Transport and the costs have been prorated to a 1967 index. No attempt has been made for the present purposes to include forecast projections for these airports through an extended forecast period. It is intended that this information be provided when the Planning Guide is updated. This information will be useful for comparing the increase in capacity requirements to projected facility requirements when faced with similar situations overseas.

The building plans of the terminal facilities have been broken down into major elements in order to provide an indication of the areas allocated to respective functions as the facilities stand at the present moment. The analysis is purely objective and does not seek to point out the lessons that are to be learned from these existing facilities, the majority of which are obvious. However, it is accepted that the standards of the terminal facilities produced in Canada over the past ten years are highly regarded throughout the world. Certainly the facilities have, in the main, served the purpose for which they were built and have provided a basis for improvements and for development of new concepts to meet the requirements of the 1970's.

There has been no attempt made to provide specific conclusions in this analysis. The purpose of the analysis is to provide background information for consultants to draw their own conclusions and to apply the relevant information according to the circumstances involved with such overseas opportunities as arise. The important thing about this section is that it provides certain facts and figures which may be of use when determining the needs for overseas airports. There are one or two areas where the information was not available at the time of going to press, and these will be up-dated at the first annual up-dating of the Planning Guide.

When considering the cost of facilities in Canada it should be noted that there were factors which affected the cost, particularly the cost per square foot of buildings and the cost per square yard of aircraft manoeuvring areas, which were the result of specific instances related to specific airports.

For example, the construction of the Aeroquay at Toronto was delayed considerably due to continued labour disputes which resulted in the opening of the Aeroquay some three years later than originally intended. This affected the rate at which the forecast capacity was reached.

OUTLINE

Another example is that of Edmonton International Airport. This airport is a prime example of good layout starting with virgin territory and based on a Master Plan using a ten year forecast period. The basis of the forecast requirements was dependent on the phasing out of the existing Municipal Airport. This phasing out has not proceeded as planned, partly because of the economic factors involved in the capital expenditure required for relocating current operators at the Municipal Airport involved with ancillary services. Partly also because the only air shuttle service in Canada operates between Edmonton and Calgary. The distance between Edmonton and Calgary makes such an air shuttle service economically viable provided the Municipal Airport in Edmonton is kept in service. There is an excellent highway between Edmonton and Calgary. The comparatively short distance between the two towns is such, that should the Municipal Airport be phased out and the shuttle service be moved, the public will tend to travel by road rather than by air. Ultimately, the Municipal Airport will be phased out. This is a question of time and economics and the long-range effects of the positioning of the new International Airport in respect to the development of Edmonton itself.

Regarding the cost of Montreal airport, there were extensive changes during the construction period resulting in extras which affect considerably the unit costs. Montreal Terminal was designed at the time when jet aircraft were not yet in operation. The effect of their introduction part way through the construction period resulted in the necessary changes in the design of the terminal building which consequently affected the overall cost.

The effects of such factors makes a genuine comparative analysis between various airports extremely difficult, unless all the statistics required have been compiled and retained in a balanced and uniform manner.

GENERAL INFORMATION

The information contained in this Section was derived from the master plan airport layouts, for the respective airports, compiled by the Department of Transport during 1966. It is proposed that this Section be updated in conjunction with the updating of the master plans by the Department. For the initial publication of the Planning Guide information on some of the airports was not available, and in some cases more up-to-date information has been included as indicated.

The items of general information covered are as follows:

Airport History

Climatic Conditions – Rainfall, Snowfall

– Prevailing Winds, Worst Weather Winds

– Temperatures

Population of Metropolitan Area served

Local Economy of Area served

Roads, Land Use, and Transport

Land Use (acreage)

Local Terrain

Air Traffice Volumes – Itinerant

– Local

Passenger Volumes (Enplaned, 1966) – Domestic

– International (Total)

Runways – Construction

– Length, Width

– Identification

– Bearing Capacity (Class)

Navigation Aids

GENERAL INFORMATION

Airport Lighting

Terminal Gates (Number)

Terminal Space Inventory

Vehicle Parking Spaces - Public

- Employees

Air Services Classification

Personnel Summary

AIRPORT HISTORY

MONTREAL

In 1940 the Department of Transport acquired 1500 acres of land at Dorval P.Q.. Three paved runways 4000' x 200' were under construction in October of that year and by September 1941 all airline operations had been moved from St. Hubert to Dorval. It became the base of the North American operations of the R.A.F. Ferry Command until the end of World War II.

A temporary licence was issued on September 1, 1941 and a terminal building completed in February of the following year. The Department of Transport took over the building and facilities of the R.A.F. in February 1946 and issued a permanent airport licence on December 11 the same year.

In January 1950 the District Inspector of Eastern Airways forecast the noise problem expected with the future advent of jet aircraft. The first complaint of noise disturbance was received in May 1951, this problem reaching a peak in magnitude about 10 years later and then gradually declining. Current noise abatement procedures preclude turbojet operations for technical stops or charter flights between 2300 and 0700 hours local time, and the introduction of scheduled flights using turbojet aircraft between midnight and 0700 hours is not permitted.

By January 1952 two runways had been extended to 7000 feet, the NS runway remaining at its original length of 5270 feet. The construction of the new terminal begun in May 1956 was completed in December 1960 and the airport renamed Montreal International Airport (Dorval). During the various periods of its history Montreal has been the busiest airport in Canada. The airport acts as an alternate on occasions when major airports in North Eastern United States are closed.

Consultants were commissioned in 1966 to prepare a Twenty Year Master Plan Report, the recommendations of which are under study as of April 1968.

AIRPORT HISTORY

TORONTO

In January 1937 the Toronto Harbour Commissioners requested financial assistance for municipal airport development. The site finally recommended the following April was at Malton, 17 miles from the city centre.

Contract work on two 3000' x 150' runways was commenced and by September 1938 runway hardsurfacing and lighting installations were completed. Trans-Canada Airways began a scheduled service on October 18, 1938.

With the leasing of the airport by the City to the Department of Transport, a permanent licence was issued on January 24, 1939. After World War II the City requested the Department of Transport to take over but it was April 1957 before final agreement was reached and the airport transferred for one dollar.

In the meantime an Instrument Landing System had been commissioned during May 1948 and on April 16, 1951 the airport named a supplementary of the North Atlantic Route. By the end of August 1957 the extension of runway 14L-32R by 5050' to a total length of 11,050' was completed.

The name of the airport was changed to Toronto International Airport (Malton) in November 1960 and construction commenced on the new terminal complex consisting of Aeroquay, Power Plant, Control Tower, Administration Offices and Post Office. A new 9500' x 200' runway was completed in November 1962 and the terminal opened for operation in January 11, 1964.

Two Aeroquays had been planned to meet the anticipated needs for 1971, with construction completion expected during 1961. Labour disputes delayed construction, and for budgetary reasons only one Aeroquay was built.

As a result of the Twenty Year Master Plan Report prepared by Consultants in 1967, an interim second terminal facility, to increase passenger handling capacity to 5.5 million per year, will be completed in 1969. Capable of being enlarged, this will represent the first stage of implementation of the recommendations of the Master Plan Report.

Current noise abatement procedures preclude the operation of turbojet aircraft for technical stops or charter flights between 2300 and 0700 hours local time, and the introduction of scheduled flights using turbojet aircraft between midnight and 0700 hours local time is not permitted.

The first complete centreline runway lighting system in North America has been installed on Runway 05R-23L. Completed in April 1968 this all-Canadian system will constitute an essential component of ground facilities necessary for the implementation of Category II operations expected before the end of 1968.

VANCOUVER

Vancouver International Airport is located on Sea Island approximately eight miles from downtown Vancouver. From its inception in 1931 until June 1962 the airport was administered by the City of Vancouver with the exception of the period August 1, 1940 to October 31, 1947 during World War II. On June 1, 1962 the Department of Transport acquired the City's interests in land, buildings and equipment and took over the operation of the airport.

The original land purchased covered 475 acres and the initial development consisted of a single 2400' x 100' runway, a small administration building and two hangars. Later developments carried out between 1936 and 1938 included two 3000' long hardsurfaced runways, taxiways, field lighting and radio meteorological building. In 1942 extensive improvements were carried out including lengthening and strengthening of runways, construction of additional hangars and other buildings.

The first airport administration building was destroyed by fire in February 1949 and replaced by a temporary structure completed in March 1950. A further addition to this building was made in 1952 to meet the airlines' increasing space requirements. In 1953 runway 08-26 was constructed to replace the oroginal main runway.

By 1956 increases in passenger and air freight traffic made it necessary to expand and on July 1, 1957 the West Terminal Building was opened. A new cross-wind runway was completed and placed in operation in 1961 and in the same year Trans-Canada Airway's new multi-million dollar maintenance base went into service in the 'Central Area' of the airport. Further expansion was carried out in 1963 with the extension of the North Terminal Building. Work is now proceeding on the new terminal being built in the 'Central Area' and is scheduled for completion by 1969.

The Twenty Year Master Plan Report prepared by the Department of Transport will determine the future incremental development.

AIRPORT HISTORY

OTTAWA

The airport was first leased by the Ottawa Flying Club from private interests in 1928. Laurentian Air Services purchased the field in 1936 and sold it in 1938 to the Department of Transport who improved the facilities by laying two 3000' runways. The airport was formally opened on August 20, 1938 at which time a temporary licence for day use only was issued. A permanent licence was granted on April 23, 1940 after lighting had been installed.

The airport was designated for military purposes on December 23, 1939 and a Service Flying Training School established by the R.C.A.F. as the first school of its kind in Canada. After the war, surplus Training School buildings were transferred to the Department of Transport.

In 1951 two new runways were constructed south of the existing runway layout, one 6000' x 200' and the other 8800' x 200'. On July 15, 1954 the airport was designated as an alternate airport for North Atlantic operations.

The new terminal building was completed in June 1960 followed by the construction of a modern Department of Transport aircraft hangar and operations base and the extensions of runways 14-32 and 07-25 to 10,000 and 8,000 feet respectively. The name of the airport was changed to Ottawa International Airport on August 24, 1964.

HALIFAX

In 1927 the Civil Aviation Branch of the Department of National Defence asked the City to consider the provision of an airport. Selected sites were evaluated in July 1928 and a location at Bluebell Farm recommended. Work began in June 1930 on two 600' wide landing strips. A temporary public licence was issued on January 9, 1931 and the City leased the airport to the Halifax Flying Club for operation and maintenance. A permanent licence was issued on June 1, 1931. In the Fall of 1938 the Department of Transport made improvements to the drainage and extended the length of both runways by approximately 200' to 2000' and 2200' overall.

During 1938/39 studies were made to see if it were practicable to expand the airport for airline use. As a result of these studies it was decided that it could not be adequately developed for this purpose. With the advent of war the airport was converted to an army camp and the airport licence cancelled in October 1941.

Surveys aimed at establishing the location of a new airport outside the city were commenced in 1945. Many sites proved unsuitable and in 1952 Trans-Canada Airlines suggested that an area north of Waverley near Kelly Lake be examined. Weather observations were then undertaken for two years and the results proved satisfactory for future development. In April 1955 the City expropriated the site and by November the same year the Department of Transport had commenced construction of two runways 6300' and 8000' long. The airport was completed sufficiently by June 1960 to permit the issue of a temporary licence for day VFR operations only. A new licence permitting full operation was issued the following month and the Terminal Building opened on September 10.

AIRPORT HISTORY

EDMONTON

The Edmonton International Airport is located on a 7300 acre site approximately 11 miles south of the city in the Nisku-Leduc area. Construction began in 1957 and was completed sufficiently for operations to commence in the Fall of 1960 using two main runways 10,200' and 11,000' long. A hangar type of structure was leased from Northwest Industries Limited as a temporary terminal building. The original licence for operation of the airport was issued on November 14, 1960.

By early 1964 the new Terminal Building had been completed with associated Customs, Immigration, Health, Telecommunications, Meteorological and Air Traffic Control services. Approach lighting, field lighting, an instrument landing system, AASR radar, etc. were also included in the operating facilities.

The operational capacity of this airport is not being utilized as forecast primarily because the expected effects of its construction have not yet been realized. The phasing out of the Municipal Airport has not proceeded as anticipated. This has resulted primarily from the location disadvantages vis-a-vis the Edmonton-Calgary air shuttle service, and the relocation problems faced by associated commercial interests located at the Municipal Airport.

AIRPORT HISTORY

VICTORIA

In 1937 the Department of Transport became interested in establishing an airport on Southern Vancouver Island. At that time the Department of National Defence was also looking for a site in this area and had engineering studies in progress. The present location near Sidney was ultimately decided upon and a joint DOT/DND Committee formed in 1938 to develop plans for the airfield.

Actual construction started in the Summer of 1939 and paving of the runways was completed by early 1940. Although the airfield was operated by the R.C.A.F. as a military facility until 1947, approval for Trans-Canada Airways to use it for a proposed scheduled service to Vancouver was granted in 1942. This service did not in fact begin until September 1946.

In 1947 the Department of National Defence withdrew most of its operations, the airport being formally transferred to the Department of Transport on May 18, 1948 and a temporary licence issued. A permanent licence for 24 hour operation was given on September 8, 1950. On May 22, 1959 the name of the airport was changed from Victoria (Patricia Bay) to Victoria International Airport.

A contract was let in the Fall of 1961 for the extension of runway 08-26 to 6000' and the installation of a hazard beacon on Mount Taum.

AIRPORT HISTORY

QUEBEC

The original airport was established by the Canadian Trans-Continental Group at St. Louis in the Municipality of Ste. Foy west of the city. Two 3000' long strips were developed and a permanent licence issued to the company. Subsequently the field was taken over by Canadian Airways Limited and abandoned on May 1, 1938. At the same time surveys were conducted for the location of a new airport to serve Quebec and a site 10 miles to the northeast at Ancienne Lorette was recommended due to its access to the city.

In October 1939 the Department of Transport attempted to get options on the Ancienne Lorette site for use as a training field for the R.C.A.F. but the matter was left in abeyance as the prices asked for the property were too high. However, construction of buildings for an Air Observer School eventually began in 1940 and the field opened in the Spring of 1941.

On January 12, 1944 Colonial Airways Inc. was granted permission to use the field as an alternative to Montreal. The Air Observers School which had been operated by this company closed on March 31, 1945 and the Department of Transport took over control of the airport. Formal transfer was made in the Fall of 1946 and a permanent airport licence issued on December 11 of that year. When the new air terminal with its associated Customs facilities was completed in July 1957 the airport was designated as an alternate for the North Atlantic service.

AIRPORT HISTORY

REGINA

AIRPORT HISTORY

LONDON

On January 24, 1927 the City Engineer requested information about airport requirements for a proposed site 4 miles south of the city. This site was investigated by the R.C.A.F. and being found satisfactory, a temporary licence was granted on August 10 the same year. In the following year businessmen supplied $20,000 capital to acquire this site and formed a company known as 'London Airport Limited'. By May a hangar had been erected. In June 1929 the City turned down a request to share the cost of field lighting and the airport subsequently closed in November. Eventually the company provided beacon lights and the airport opened again in January 1931.

Early in 1935 surveys were commenced investigating the adequacy of the airport and the probable need to establish a new airport at a new location. By 1939 a site had been selected near Rebecca approximately 4 miles north east of the city and work commenced on the initial contract in September of that year. In November the following year the City agreed to lease the field to the Department of National Defence for use by the R.C.A.F. as a training school for the British Commonwealth Training Plan.

An airport manager was appointed and a temporary licence issued in May 1941. This was superceded by a permanent licence on May 1, 1942 and the following August the original airport was closed. After World War II the City declined to accept responsibility for the airport and the Department of Transport took over its operation. In September 1950 an Instrument Landing System on runway 14-32 was provided.

The City was requested in December 1960 to transfer the City-owned portion of the airport to the Department to permit construction of a new terminal building. The transfer was made and the terminal constructed and opened for passenger service in early 1956. Space was provided in the building for the Telecommunications, Meteorological and Civil Aviation Departments.

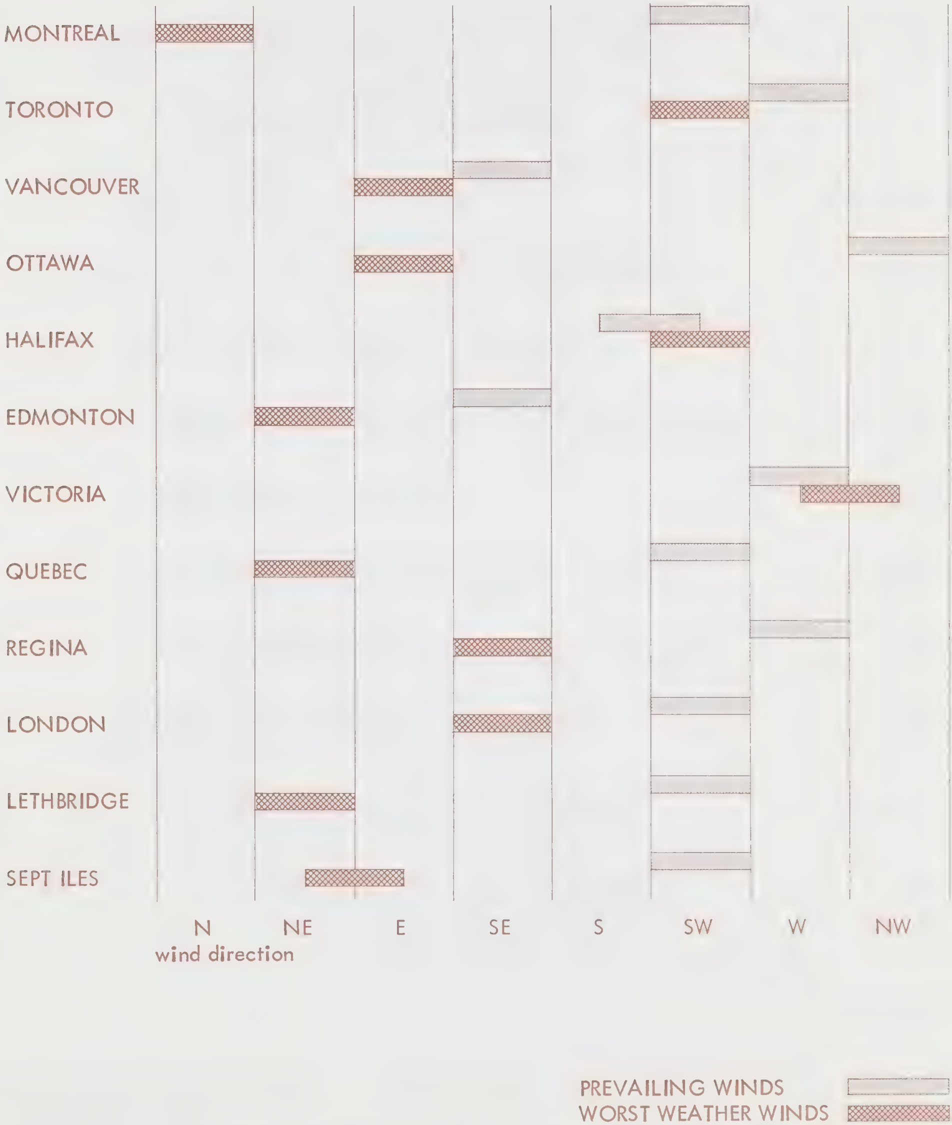
AIRPORT HISTORY

LETHBRIDGE

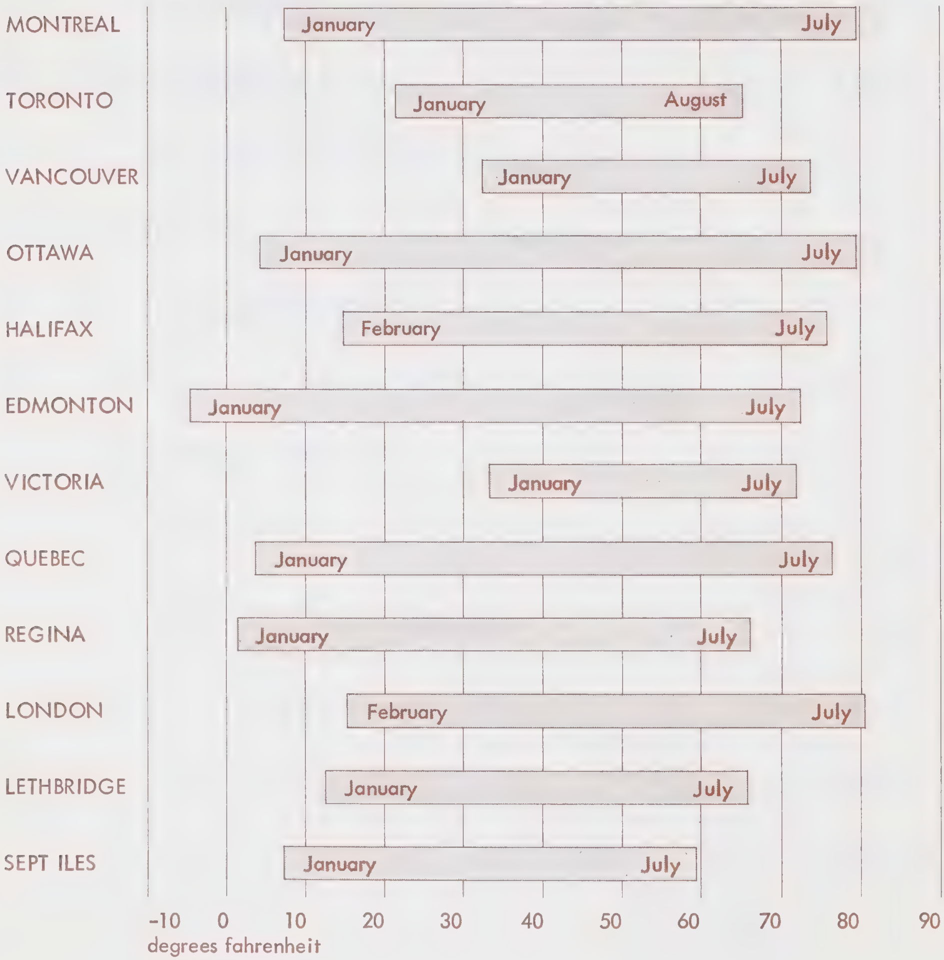
SEPT ILES

CLIMATIC CONDITIONS

CLIMATIC CONDITIONS

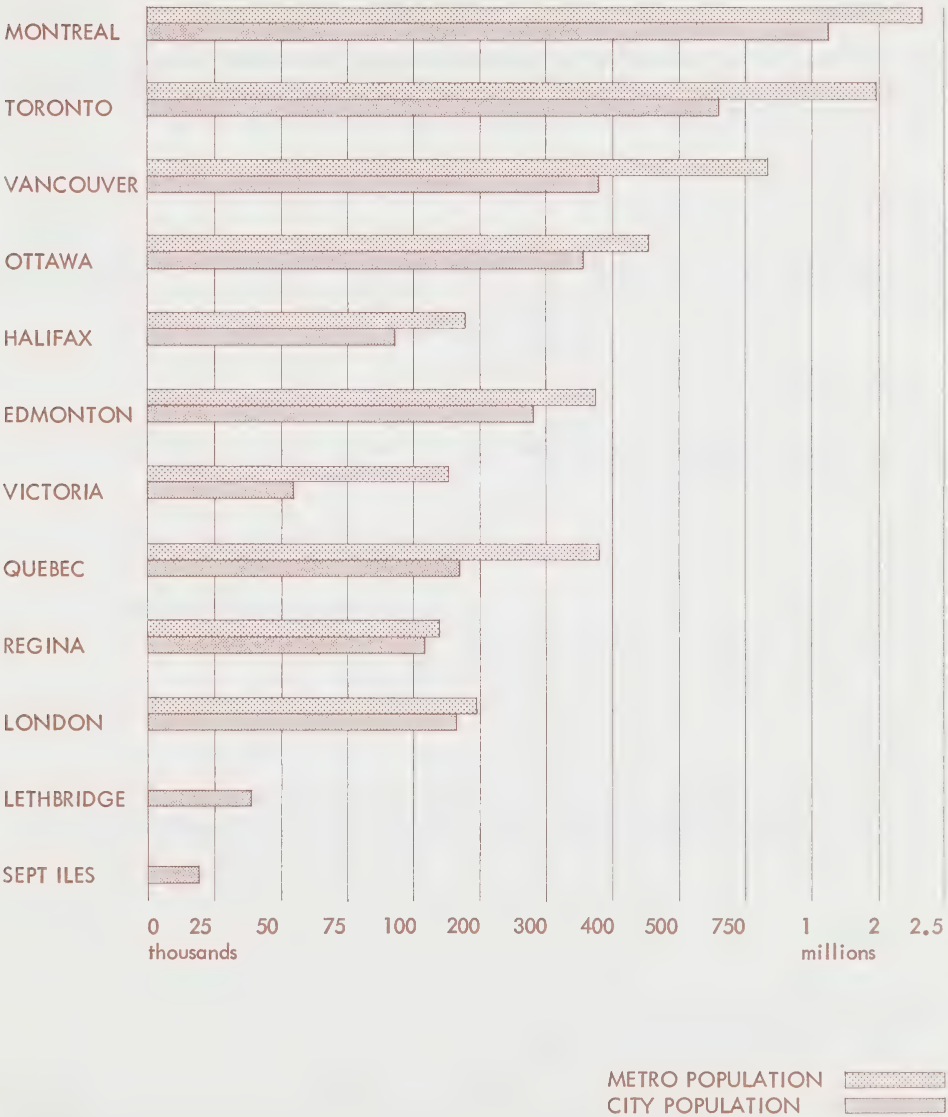


CLIMATIC CONDITIONS



MEAN TEMPERATURES

POPULATION


MONTREAL
TORONTO
VANCOUVER
OTTAWA
HALIFAX
EDMONTON
VICTORIA
QUEBEC
REGINA
LONDON
LETHBRIDGE
SEPT ILES
0 25 50 75 100 200 300 400 500 750 1 2 2.5
thousands
millions
METRO POPULATION
CITY POPULATION

LOCAL ECONOMY

MONTREAL

Industrial parks for light industry and trucking are developing, along the highway systems bordering the airport. Some market and landscape gardening remain, generally on a lease basis from large land owning companies.

TORONTO

Provincial Capital
Industrial

VANCOUVER

The financial, commercial and industrial centre of the Province of British Columbia having large air, rail and port terminals.

OTTAWA

National Capital.
Pulp and paper, light industry and dairy farming.

HALIFAX

The airport is surrounded by woodland and has no built-up areas in the immediate vicinity. The nearest communities are Enfield, 5 miles north and Waverley 5 1/2 miles south south-west.

EDMONTON

Provincial Capital.
Agriculture - grain growing.
Oil wells - petroleum drilling operation.

LOCAL ECONOMY

VICTORIA

Provincial Capital.
Harbour, fishing, farming and lumbering.

QUEBEC

Provincial Capital.
Deep sea port, distribution and manufacturing centre, shipbuilding, lumbering, pulp and paper, dairying and textiles.

REGINA

Provincial Capital

LONDON

Industrial, educational and agricultural

LETHBRIDGE

SEPT-ILES

ROADS, LAND USE AND TRANSPORT

	ROADS		TO CITY CENTRE			ADJACENT LAND USE				OTHER PUBLIC TRANSPORT			
	Highway	Municipal	Minutes	Miles	Direction	Residential	Industrial	Agricultural	Natural	Bus	Rail	Boat	VTOL / STOL
MONTREAL	●		45	7	E	●	●	●		●	●		
TORONTO	●	●	45	17	E	●	●	●		●	●	●	
VANCOUVER	●	●	30	9.5	N	●	●	●		●	●	●	
OTTAWA		●	35	11	N	●		●		●	●		
HALIFAX	●		50	26	S				●	●	●	●	
EDMONTON	●		40	19	N		●	●		●	●		
VICTORIA	●	●	30	20	S	●		●		●		●	
QUEBEC	●	●	30	12	SE	●		●		●	●	●	
REGINA													
LONDON		●	20	7	SW	●	●	●		●	●		
LETHBRIDGE													
SEPT ILES													

LAND USE

	COMMERCIAL	INDUSTRIAL	AGRICULTURAL	RESIDENTIAL
MONTREAL	93	165	nil	nil
TORONTO				
VANCOUVER	18	79	728	
OTTAWA	70	nil	1,406	nil
HALIFAX	7	15	nil	nil
EDMONTON	7	2	6,196	nil
VICTORIA	3	7	422	2
QUEBEC	19	nil	nil	nil
REGINA				
LONDON	4	nil	384	nil
LETHBRIDGE				
SEPT ILES				

approximate acreages

LOCAL TERRAIN

MONTREAL

The airport lies in flat open country on the island of Montreal with Mount Royal seven miles east and a gentle land rise to the west. Lac St. Louis, part of the St. Lawrence River, is 1 mile south with Valois Bay about 7000 feet southwest of Runway 06.

Soil : Silty clay - medium stiffness

Water Table : In some areas about 3' below the surface, generally lower except in swamp patches.

TORONTO

Generally flat, sloping gradually to the south-east. Two water courses adjacent; Etobicoke Creek on the south-west side and Mimico Creek on the north-east side.

Soil : Clay with some silt

Water Table : Varies with season. There is no definite depth and most ten-foot holes show no water.

VANCOUVER

Located on Sea Island in the estuary of the Fraser River. Low flat land with considerable dyke development.

Soil : Clay silt

Water Table : 1 foot from natural ground surface in Fall, dropping to 5 or 6 feet in Summer.

OTTAWA

Flat sand plateau bordered on the west by the Rideau River and Canal.

Soil : Sand

Water Table : Very low

LOCAL TERRAIN

HALIFAX

Fairly flat scrub forest. Shubenacadie Lake lies 4.5 miles north-west and several smaller lakes closer to the airport.

Soil : Shale bedrock or glacial till, sand, silt and clay mixture.

Water Table: Perched on bedrock in places.

EDMONTON

Generally flat prairie land. Borrow Pit is on the right side of the entrance road and several small lakes lie to the east of the site. Whitemud Creek flows north approximately 2 miles north-west of the airport.

Soil : Silty clay

Water Table: Localised and variable, 4 to 26 feet, generally greater than 10 feet.

VICTORIA

Rolling farmland.

Soil : Silty clay

Water Table: Variable 5 to 10 feet.

QUEBEC

Fairly flat and open countryside surrounding the airport with some scattered light wooded areas. High ridge of hills to the north-west, north and north-east; 1200 to 1400 feet high and 7 to 10 miles distant.

Soil : Variable - sand, silt and clay. Bedrock at 3 to 5 feet.

Water Table: Perched on bedrock in places. Water lying on site cannot escape due to impervious lower layer.

LOCAL TERRAIN

REGINA

Soil :

Water Table :

LONDON

Rolling agricultural land.

Soil : Clayey silt, silty clay and silty sand

Water Table : 3 to 8 feet below surface

LETHBRIDGE

Soil :

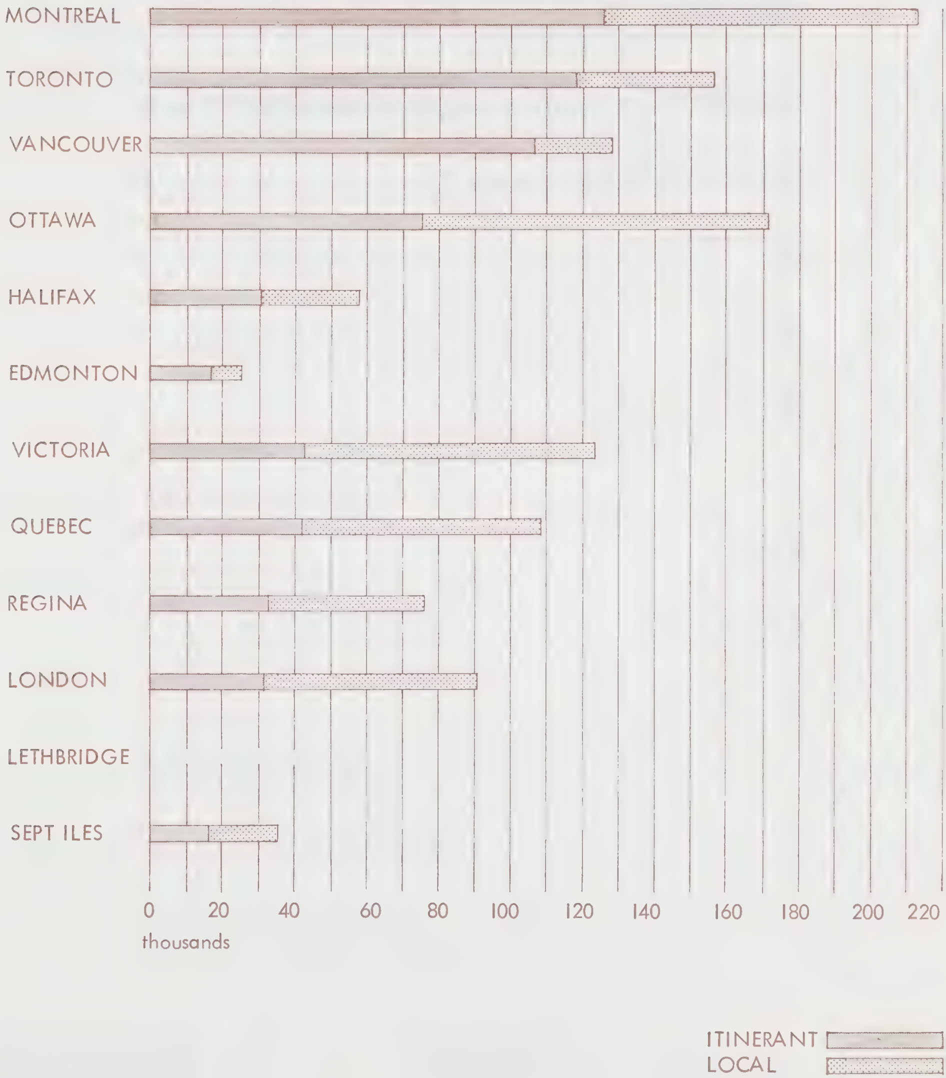
Water Table :

SEPT ILES

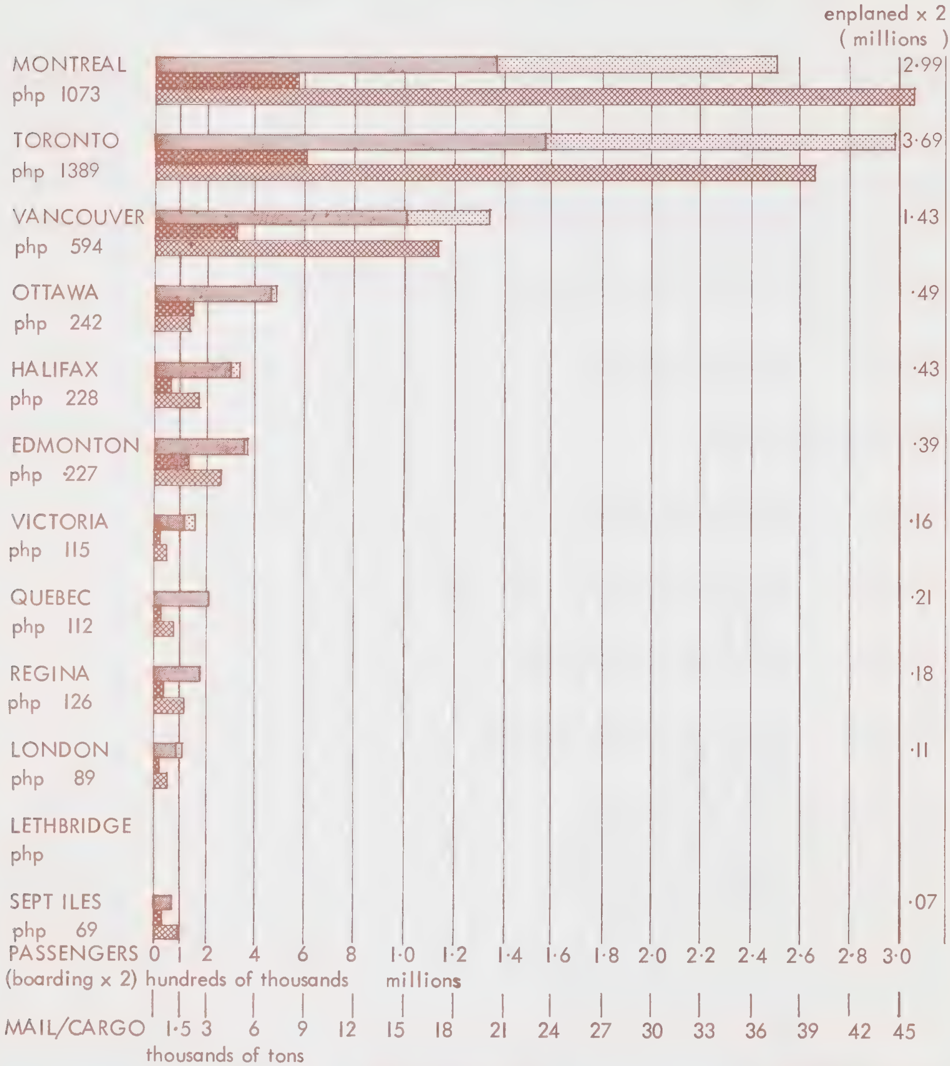
Soil :

Water Table :

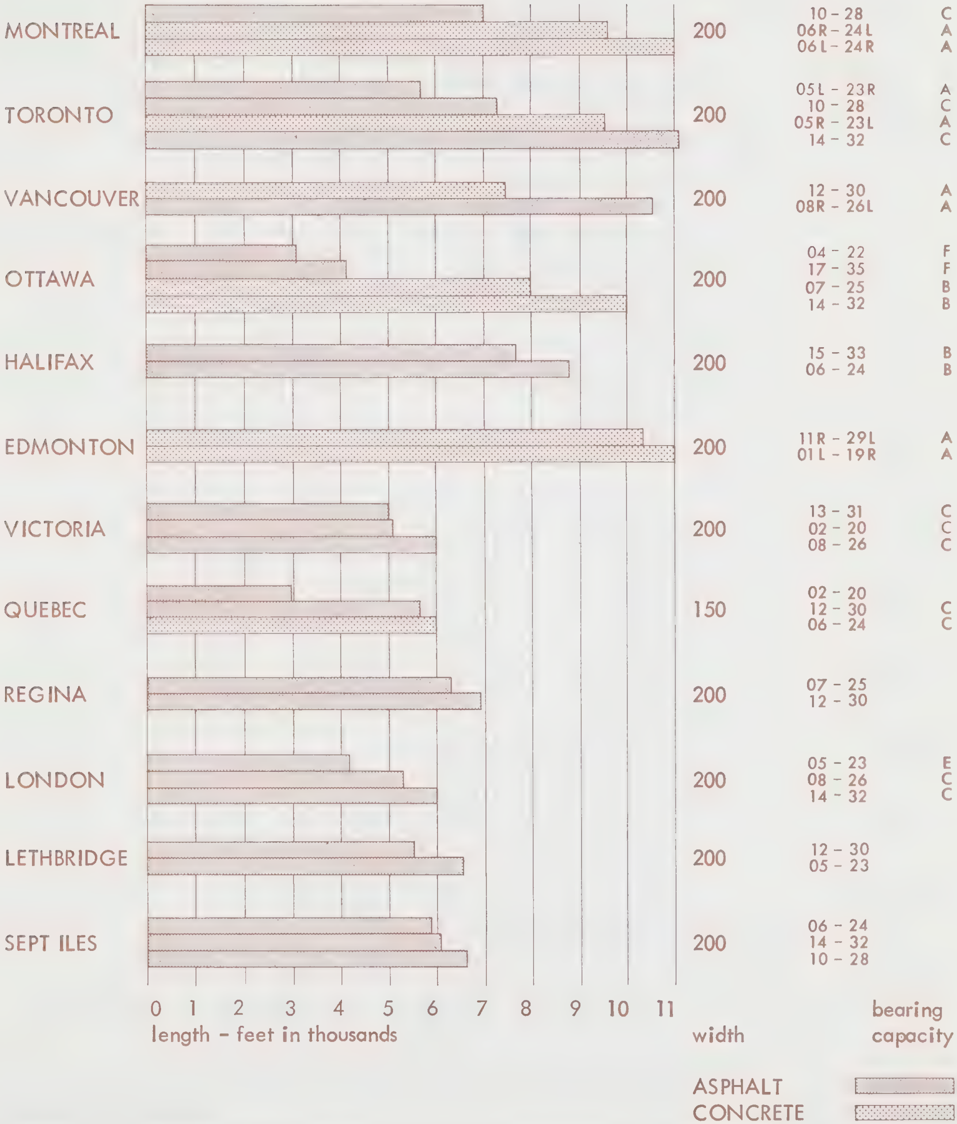
AIRCRAFT MOVEMENTS (1966)



SCHEDULED TRAFFIC (1966)- PASSENGERS, MAIL, CARGO



RUNWAYS


MONTREAL
200
10 - 28 C
06R - 24L A
06L - 24R A
TORONTO
200
05L - 23R A
10 - 28 C
05R - 23L A
14 - 32 C
VANCOUVER
200
12 - 30 A
08R - 26L A
OTTAWA
200
04 - 22 F
17 - 35 F
07 - 25 B
14 - 32 B
HALIFAX
200
15 - 33 B
06 - 24 B
EDMONTON
200
11R - 29L A
01L - 19R A
VICTORIA
200
13 - 31 C
02 - 20 C
08 - 26 C
QUEBEC
150
02 - 20
12 - 30 C
06 - 24 C
REGINA
200
07 - 25
12 - 30
LONDON
200
05 - 23 E
08 - 26 C
14 - 32 C
LETHBRIDGE
200
12 - 30
05 - 23
SEPT ILES
200
06 - 24
14 - 32
10 - 28
0 1 2 3 4 5 6 7 8 9 10 11
length - feet in thousands
width
bearing capacity
ASPHALT
CONCRETE

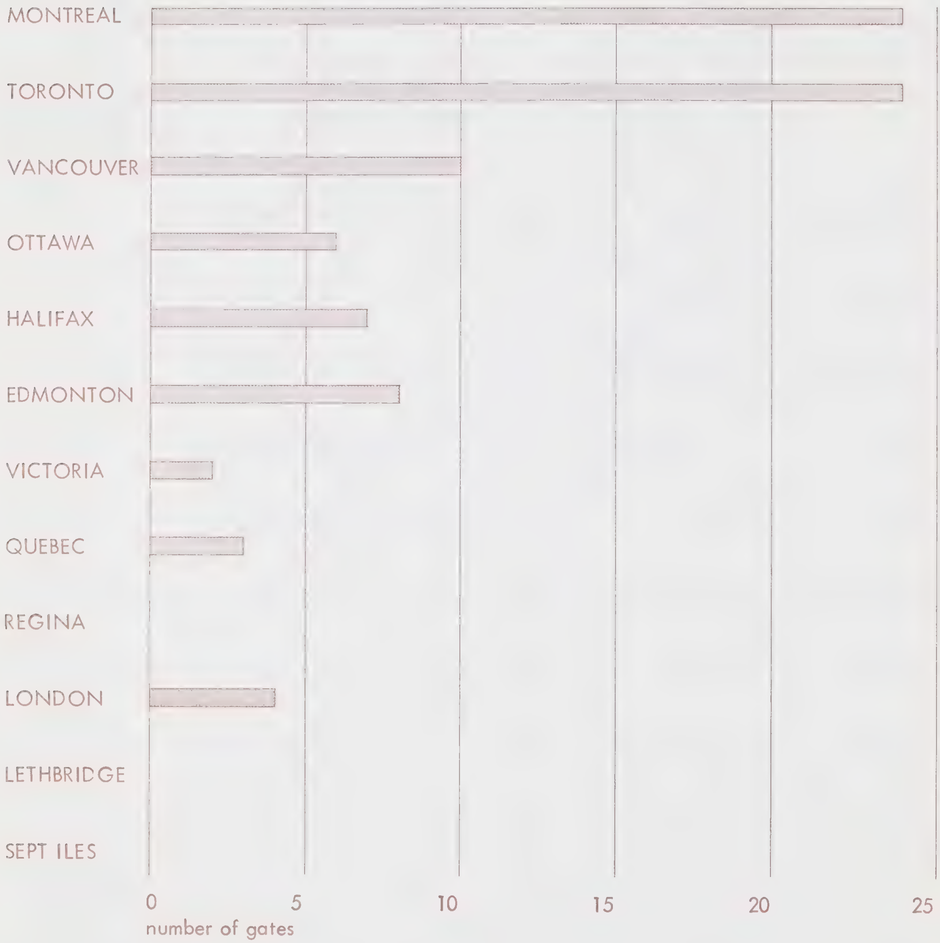
NAVIGATION AIDS

	ASR	ASR-3	ASR-5	SSR	AASR	AASR-1	PAR	GCA	ILS	NDB	DF-UHF	DF-VHF	VOR	VOT	TACAN	VORTAC	RNG	LFR	ASDE
MONTREAL		●		●		●	●		3	4			2	●					
TORONTO		●		●	●		●		4	6			●	●					
VANCOUVER	●			●	●		●		●	2	●	●	●	●	●			●	
OTTAWA						●		●	●	3	●	●	●	●	●			●	
HALIFAX						●	●		●	2			●	●				●	
EDMONTON				●		●			●	4			●	●		●	●		
VICTORIA									●	4			●					●	
QUEBEC						●			●	2			●	●				●	
REGINA																			
LONDON									●	●				●		●		●	
LETHBRIDGE																			
SEPT ILES																			

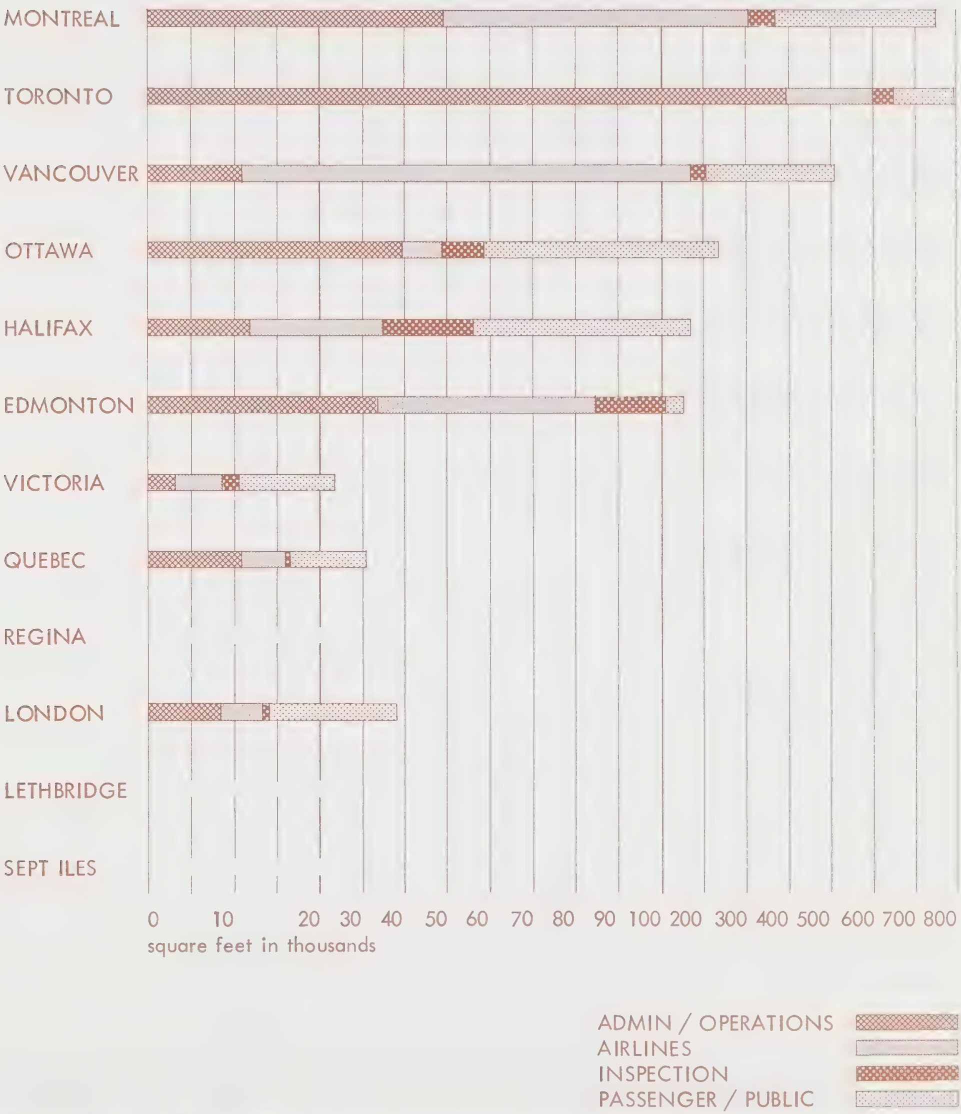
AIRPORT LIGHTING

	FIELD					APPROACH					RUNWAY		
	Rot. Beacon	Obstruction	Wind D.I.	Landing D.I.	Taxiway	High Intensity	Low Intensity	Threshold	R.I.L.	VASIS	Variable L-M	Variable M-H	Centre Line
MONTREAL	●	●			●	●	●	●	●	●		●	
TORONTO	●	●			●	●	●	●	●	●		●	
VANCOUVER	●	●	●		●	●	●	●	●	●	●	●	
OTTAWA	●	●	●		●	●	●	●	●	●		●	
HALIFAX	●	●			●	●	●	●	●	●		●	
EDMONTON	●	●	●		●	●	●	●	●	●	●	●	
VICTORIA	●	●			●	●	●	●	●		●	●	
QUEBEC	●	●	●		●	●	●	●		●	●	●	
REGINA	●	●			●	●	●	●	●	●	●	●	
LONDON	●	●		●	●	●	●	●	●		●	●	
LETHBRIDGE	●	●	●		●	●	●	●			●	●	
SEPT ILES	●	●			●	●	●	●	●	●	●	●	

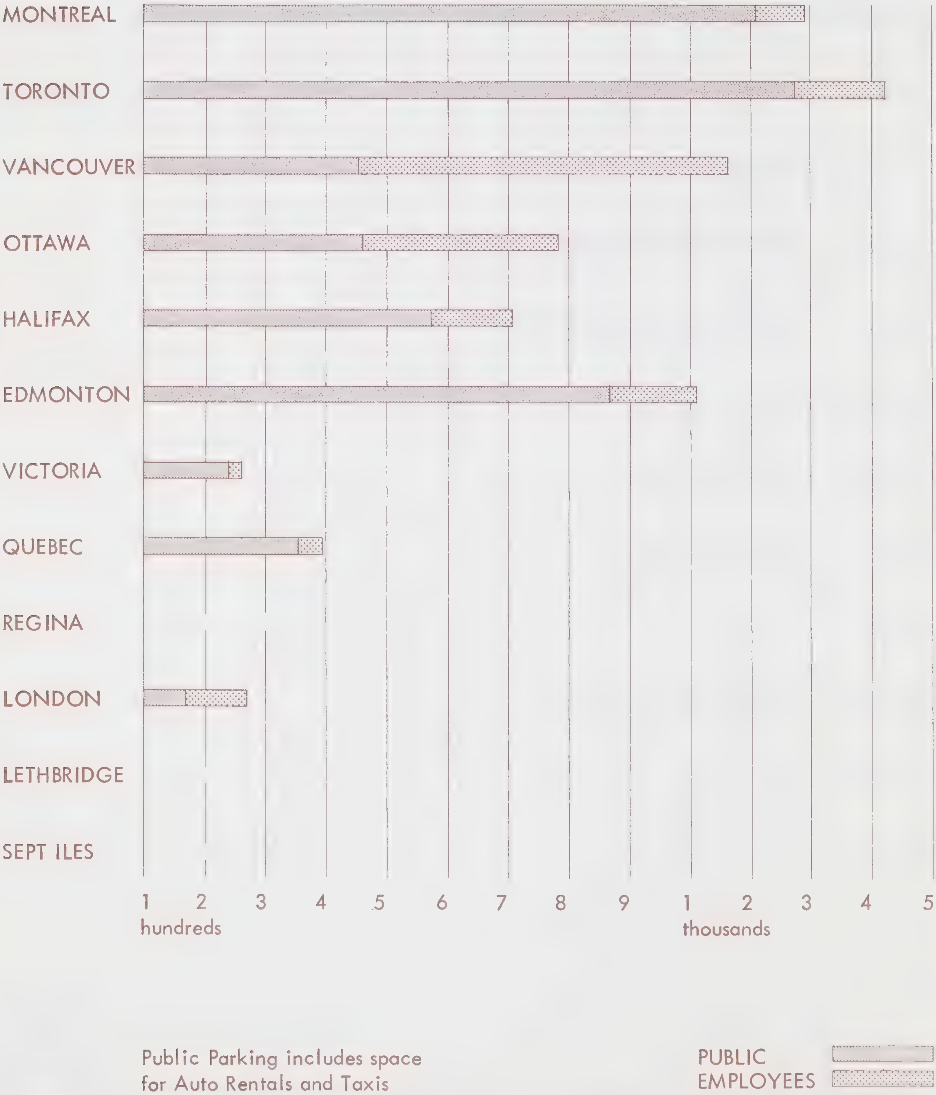
TERMINAL GATES



TERMINAL SPACE INVENTORY



PARKING SPACES



Public Parking includes space
for Auto Rentals and Taxis

AIR SERVICES CLASSIFICATION

	AIR TRAFFIC CONTROL TOWER					TELECOMMUNICATIONS AERADIO STATION					METEOROLOGICAL WEATHER OFFICE			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4
MONTREAL				●		●					●			
TORONTO				●				●			●			
VANCOUVER				●			●				●			
OTTAWA				T ●				●					●	
HALIFAX		T ●								●	●			
EDMONTON	●						●				●			
VICTORIA		●								●				●
QUEBEC			T ●						●				●	
REGINA									●		●			
LONDON			●							●			●	
LETHBRIDGE										●			●	
SEPT ILES										●		●		

PERSONNEL SUMMARY

	Airport Operations Staff	Police/ Commissionaires	Airport Emergency Service	Casual	Air Traffic Control	Telecommunications	Meteorological	Others	Air Services Staff TOTAL	Others normally working on airport	Average Number of workers daily	Peak Number during shift changes
MONTREAL	278	43	28	50	119	82	95		695	7000	3000	5000
TORONTO	211	46	28	25	115	45	76		546	2454	3000	5000
VANCOUVER	27	15	28	22	80	60	77		309	5000	3500	4000
OTTAWA	72	15	CAF	6	40	40	8	67	248	600	525	650
HALIFAX	60	10	21	7	24	20	32		174	447	333	424
EDMONTON	84	10	28	7	60	53	74		322	378	700	800
VICTORIA	14	4	CAF	2	9	9	5		43	150	120	160
QUEBEC	34	5	10	4	25	7	22		107	197	150	290
REGINA												
LONDON	31	2	10	nil	8	16	6		73	54	44	62
LETHBRIDGE												
SEPT ILES												

COSTS (Millions Canadian Dollars - 1967)

	MONTREAL	TORONTO	VANCOUVER	OTTAWA	HALIFAX	EDMONTON	VICTORIA	QUEBEC	REGINA	LONDON	LETHBRIDGE	SEPT ILES
1. ATC COMMUNICATIONS												
Equipment and installation	.78	.78	.78	.48	.5	.78	.33	.48	.48	.33	.33	.33
Buildings	.03	.03	.03	.03	.03	.03	.02	.03	.03	.02	.02	.02
2. METEOROLOGICAL SYSTEMS												
Equipment and installation												
Weather Radar	-	.28	.07	.15	.33	.28	-	.15	-	.15		
Buildings				.01				.02				
3. NAVIGATIONAL AIDS												
Equipment and installation												
AASR	.83	.83	.83	.83	.83	.83	-	.83	.83	-	-	-
ASR	.78	.78	.78	.78	.78		-	-	-	-	-	-
RBDE	.33	.38	.2	.15	.15	.2	-	.15	.15	-	-	-
RVME	.15	.2	.15	.1	.1	.15	-	.1	.1	-	-	-
RRE	-	.2	-	-	-	-	-	-	-	-	-	-
NDB	.28	.2	.18	.18	.07		.2	.1	.15	-	.15	.1
VOR	.15	.15	.08	.07	.07		.07	.07	.07	.08	.07	.1
VOT	.01	.01	.01	.01	.01		-	.01	.01	.01		
Buildings*	.35	.33	.2	.25	.48		.23	.13	.15	.05	.15	.15
4. LANDING AIDS												
Equipment and installation	.4	.5	.2	.2	.2	.2	.2	.2		.2		
Non-visual	.4	.85	.4	-	.4	-	-	-	-	-	-	-
ILS												
PAR												
Visual												
Approach, Threshold, RIL, Rotating Beacon	.25	.3	.18	.2	.23		.18	.17	.18	.18	.15	.2
Runway lighting	.18	.15	.13	.13	.1		.1	.08	.1	.1	.08	.1
Taxiway lighting	.13	.13	.15	.01	.05		.07	.04	.05	.05	.01	.05
VASIS	.05	.03	.03	.05	.03		-	.03	.03	-	-	.03
Marking												
Buildings**	.43	.58	.15	.15	.15	.15	.15	.15		.15		

COSTS (Millions Canadian Dollars - 1967)

	MONTREAL	TORONTO	VANCOUVER	OTTAWA	HALIFAX	EDMONTON	VICTORIA	QUEBEC	REGINA	LONDON	LETHBRIDGE	SEPT ILES
5. RUNWAY/TAXIWAY SYSTEMS												
Foundation preparation) Surfacing) Storm Drainage system)	7.95	9.5	8.	4.7	3.43	10.25	4.3	2.25		3.38	2.83	3.65
6. APRONS												
Foundation preparation) Surfacing) Storm Drainage system) Lighting)	7.78	5.3	4.9	1.95	.93	1.7	.83	.8		.93	.5	.43
7. PASSENGER FACILITIES												
Site preparation Structure and Cladding Furnishing, Furniture, Fine Art Building Services (E., M., etc.) External Works	39.73	35.35		6.75	5.83		.68		1.25			
8. ATC FACILITIES												
Site preparation) Structure and Cladding) Furnishing, Furniture) Building Services (E., M., etc.) External Works		1.38										
9. CARGO FACILITIES												
Site preparation Structure and Cladding Furnishings, Furniture Building Services (E., M., etc.) External Works												

COSTS

The cost estimates provided are extrapolated from information supplied by various Branches of the Department of Transport, prorated to a 1967 index. They are indicative only of the general order of magnitude of capital cost and are expressed in terms of millions of Canadian dollars (1967). Where work has been executed over a period of years the costs have been determined on the basis of the work being executed in 1967. "Prices and Price Indexes", Vol. 45-No. 9, published by the Dominion Bureau of Statistics in November 1967, was used as the source for comparative costing.

Costs expressed in millions of Canadian dollars (1967).
- indicates item not currently existing.
blank spaces indicate no information currently provided.
* Includes Land and Development, Site Selection and Road Development.
** Includes Land Development, Installation, Power and Control Costs.
*** Includes Power Supply to Navigational Aids and Landing Aids and Emergency Power Supply.

COSTS (Millions Canadian Dollars - 1967)

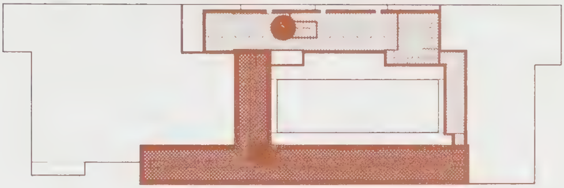
	MONTREAL	TORONTO	VANCOUVER	OTTAWA	HALIFAX	EDMONTON	VICTORIA	QUEBEC	REGINA	LONDON	LETHBRIDGE	SEPT ILES
10. AIRPORT SERVICING / MAINTENANCE FACILITIES												
Site preparation)	3.7			.68	.4			.23				
Structure and Cladding)												
Furnishings, Furniture)												
Building Services (E.,M.,etc)												
External Works)												
11. CAR PARKS / APPROACH AND SERVICE ROADS												
Foundation preparation)	1.07	.6			.18							
Storm Drainage system)					.88							
Surfacing)												
Lighting)												
12. POWER SUPPLY***												
Equipment)	.33	.28	.23	.28	.15		.13	.13	.13	.13	.13	.13
Distribution system)												
Buildings)												
13. WATER SUPPLY												
Equipment)	.02	.33			.04							
Distribution)												
Buildings)												
14. OTHER SITE SERVICES		3.4			.13							
15. AVIATION FUEL SUPPLY SYSTEM												
Equipment)	1.2											
Distribution)												
Buildings / Tank Farm)												
16. LAND ACQUISITION												

BUILDING PLANS

This Section contains reproductions of terminal building layouts graphically presenting basic functional divisions and circulation flow patterns.

The prime purpose is to provide an indication of area allocation and interrelation of function, and the flow concepts adopted at the time the terminals were designed.

Photographs of a number of the terminal buildings represented are included in the Section titled "Photographs".



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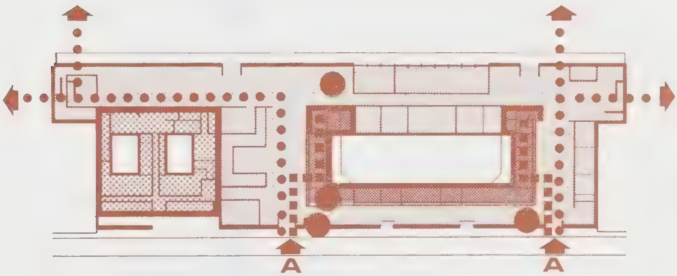

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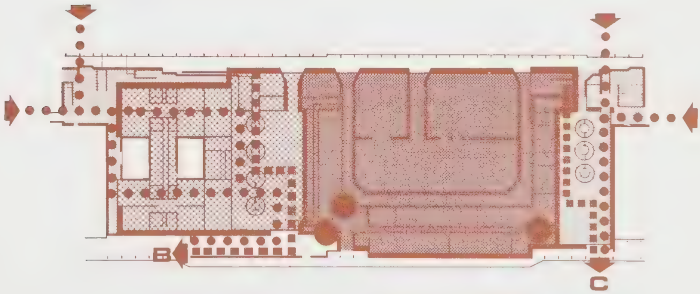
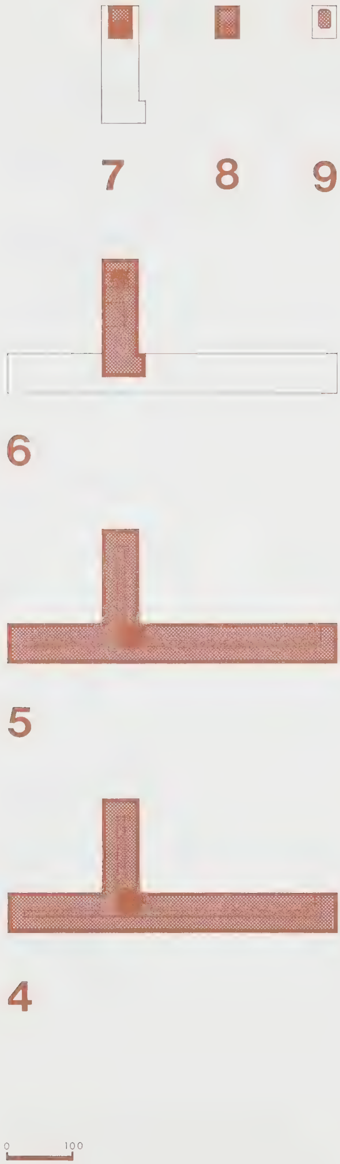


1

1 100

MONTREAL



MONTREAL

BUILDING PLANS

MONTREAL

TORONTO

VANCOUVER

OTTAWA

HALIFAX

EDMONTON

VICTORIA

QUEBEC CITY

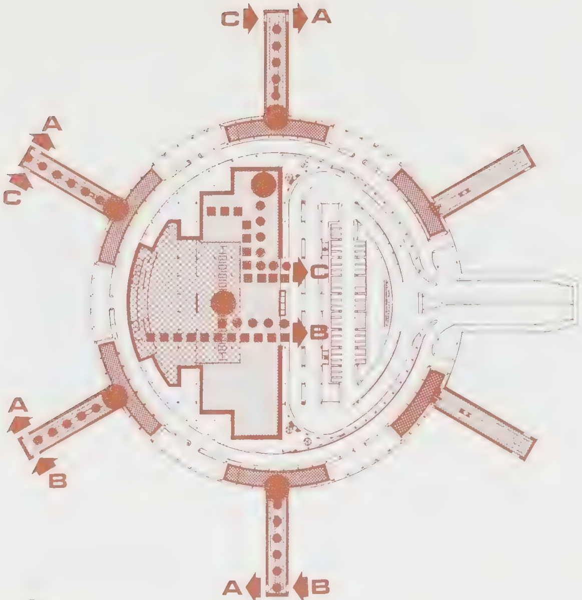
REGINA

LONDON

LETHBRIDGE

SEPT ILES

ADMINISTRATION & OPERATIONS	
AIRLINES FACILITIES	
INSPECTION FACILITIES	
PUBLIC/PASSENGER FACILITIES	
ENPLANING PASSENGERS	A
DEPLANING INTERNATIONAL	B
DEPLANING DOMESTIC	C
BAGGAGE	
VERTICAL CIRCULATION	
FLOOR KEY	4 3 2 1 0



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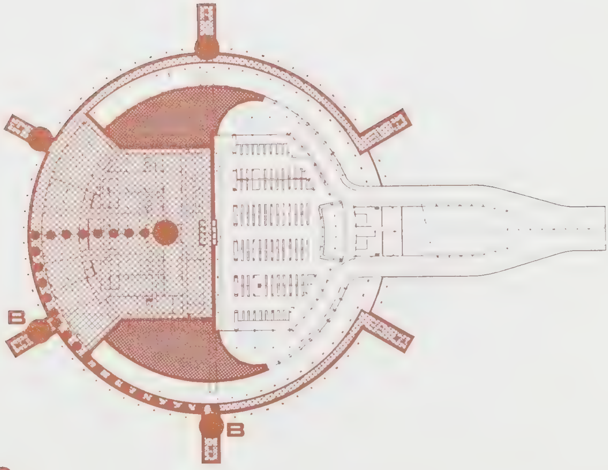

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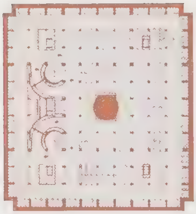
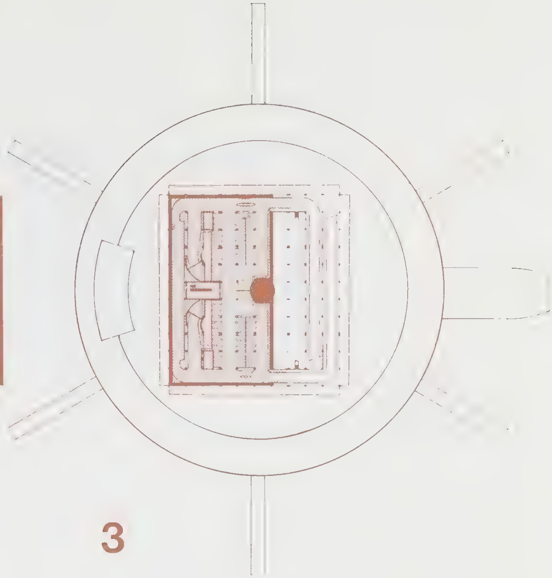
TORONTO





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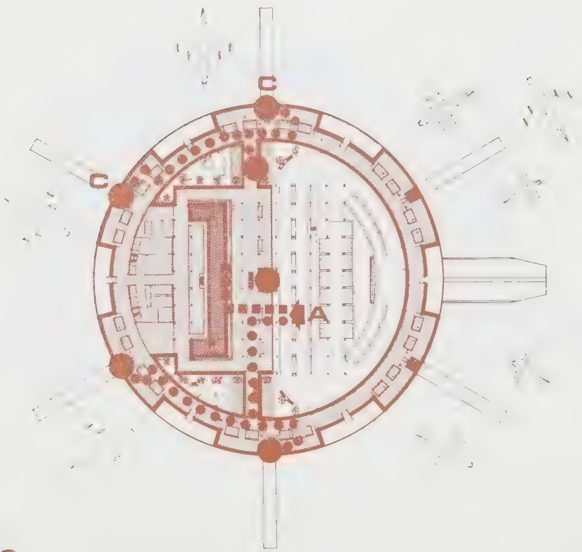

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TORONTO

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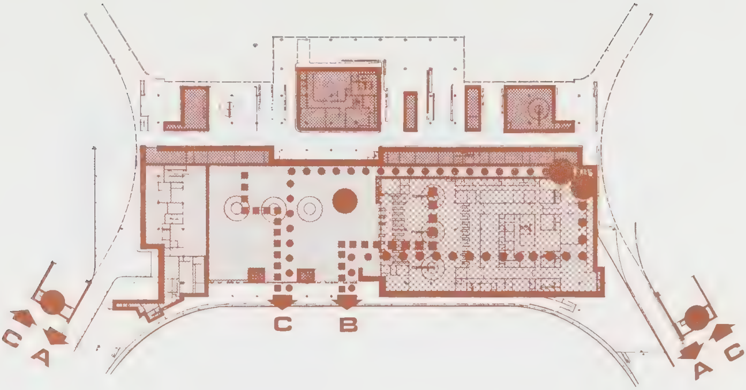

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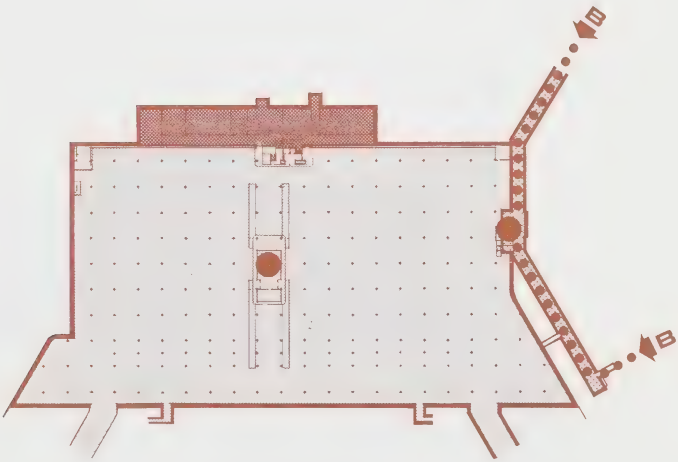

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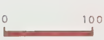
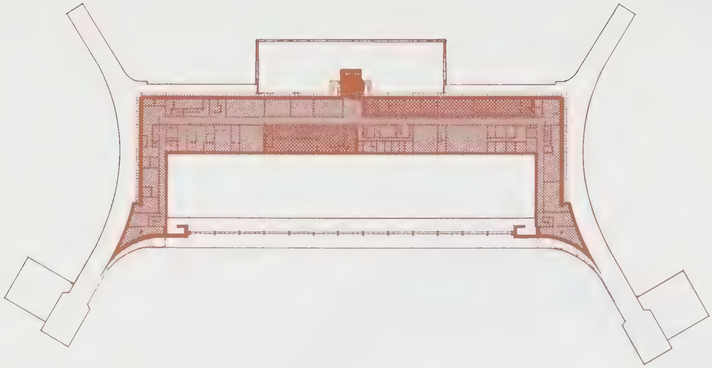


VANCOUVER



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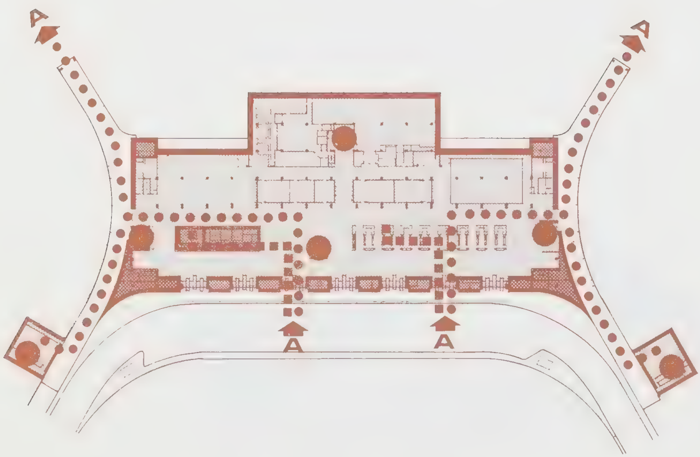

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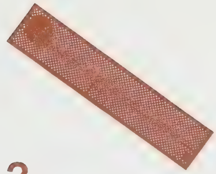
VANCOUVER



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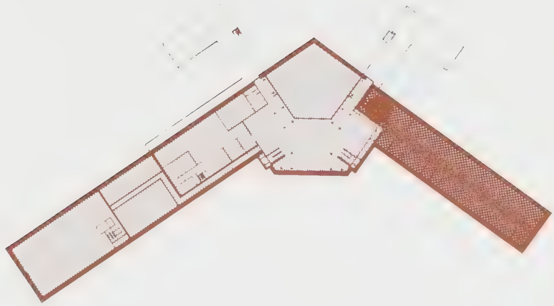

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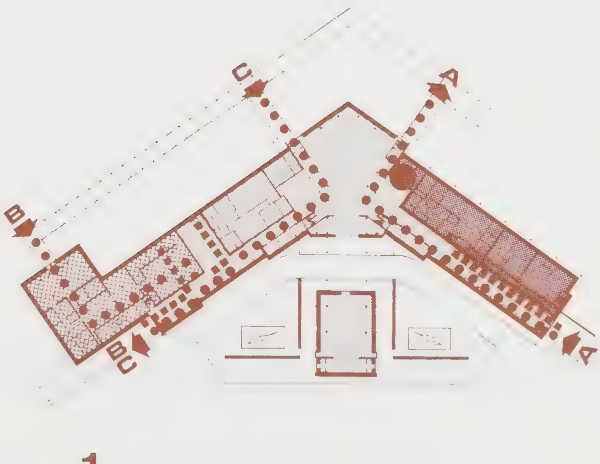

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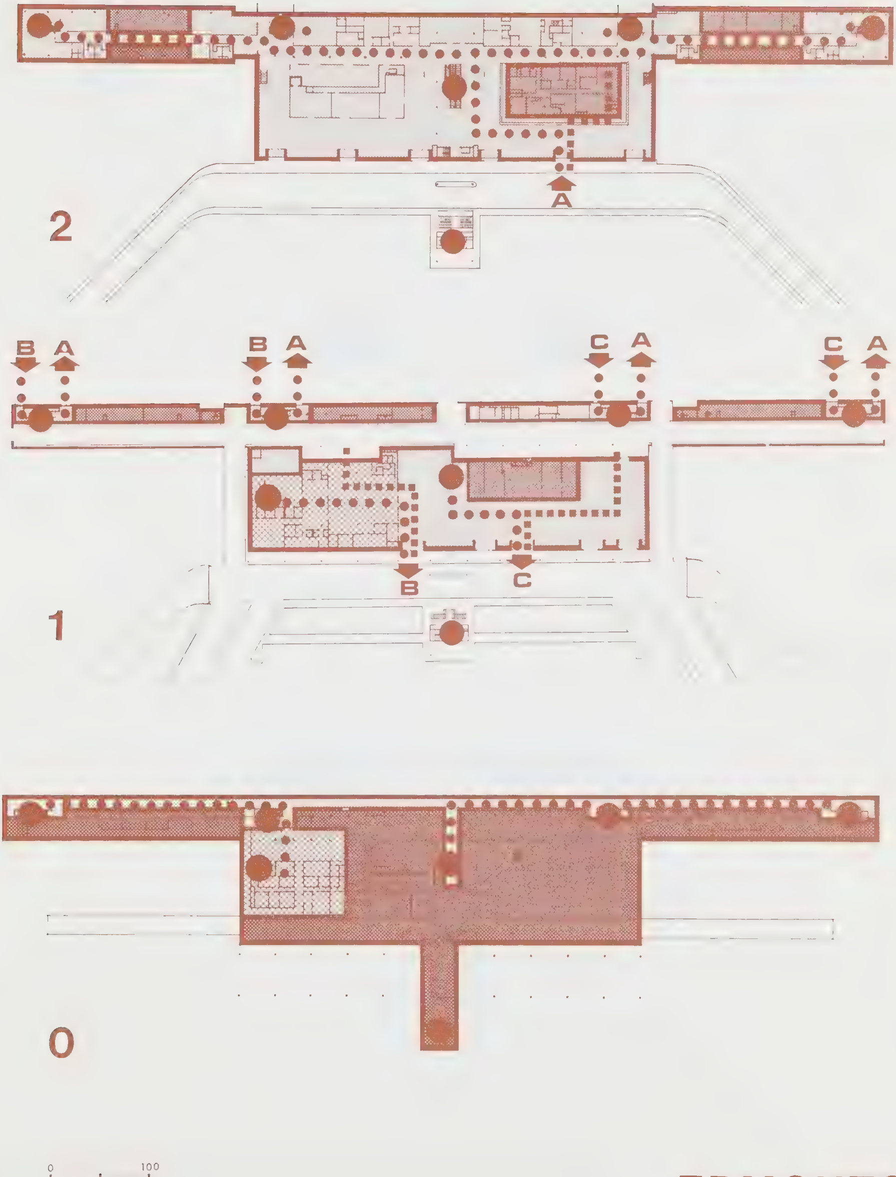
1 100

OTTAWA

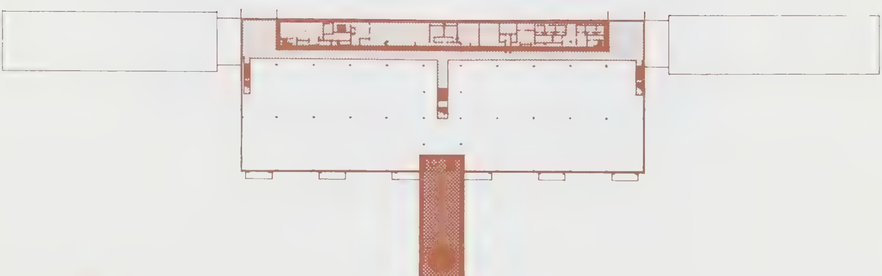
HALIFAX



EDMONTON

5 6 7 8 9

4



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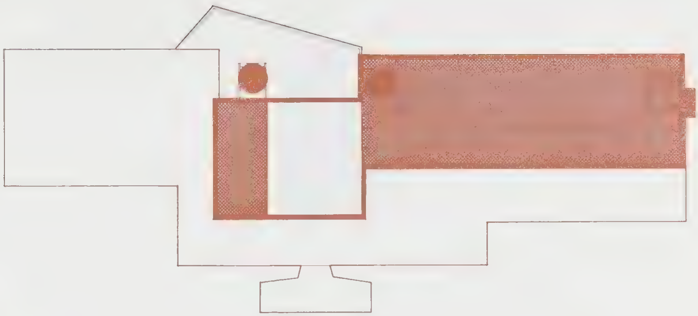
EDMONTON



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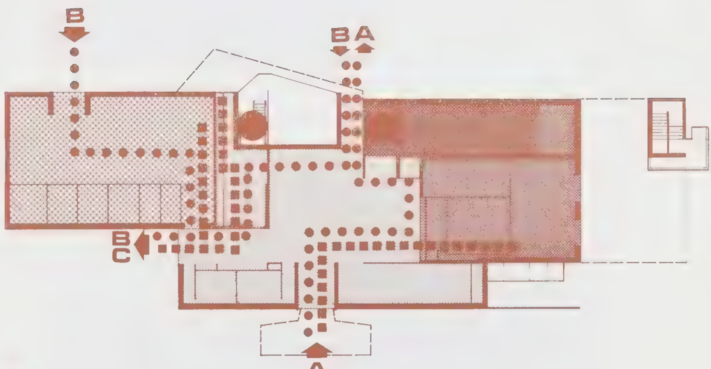

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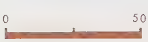
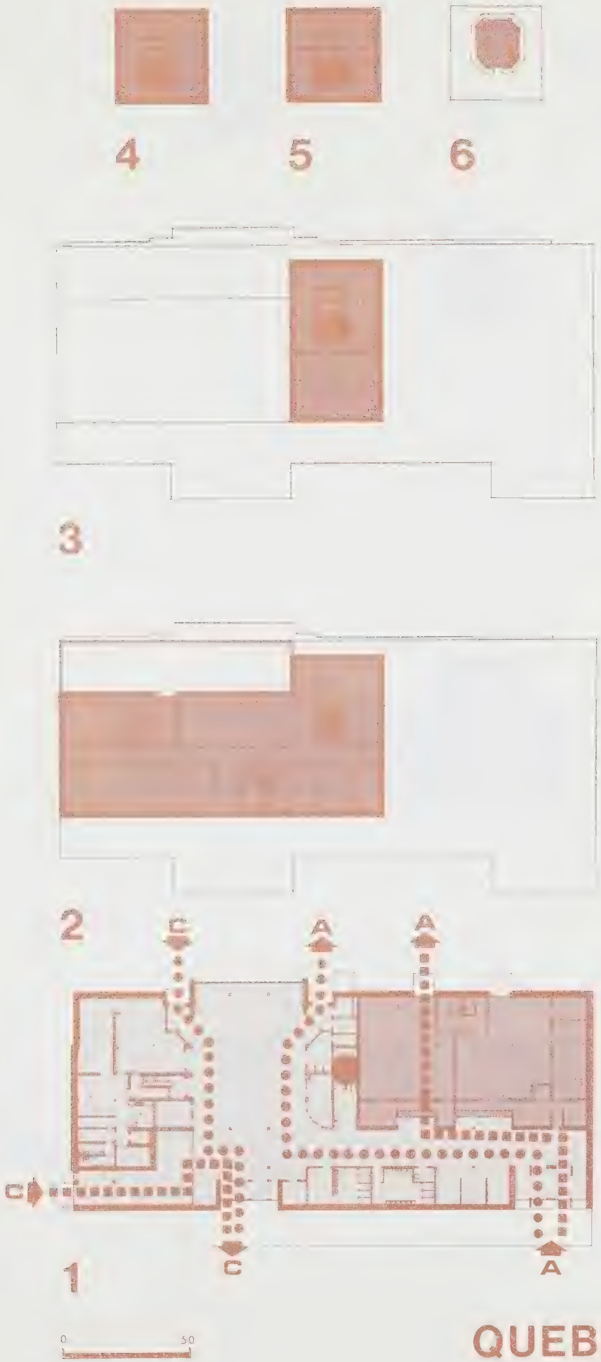
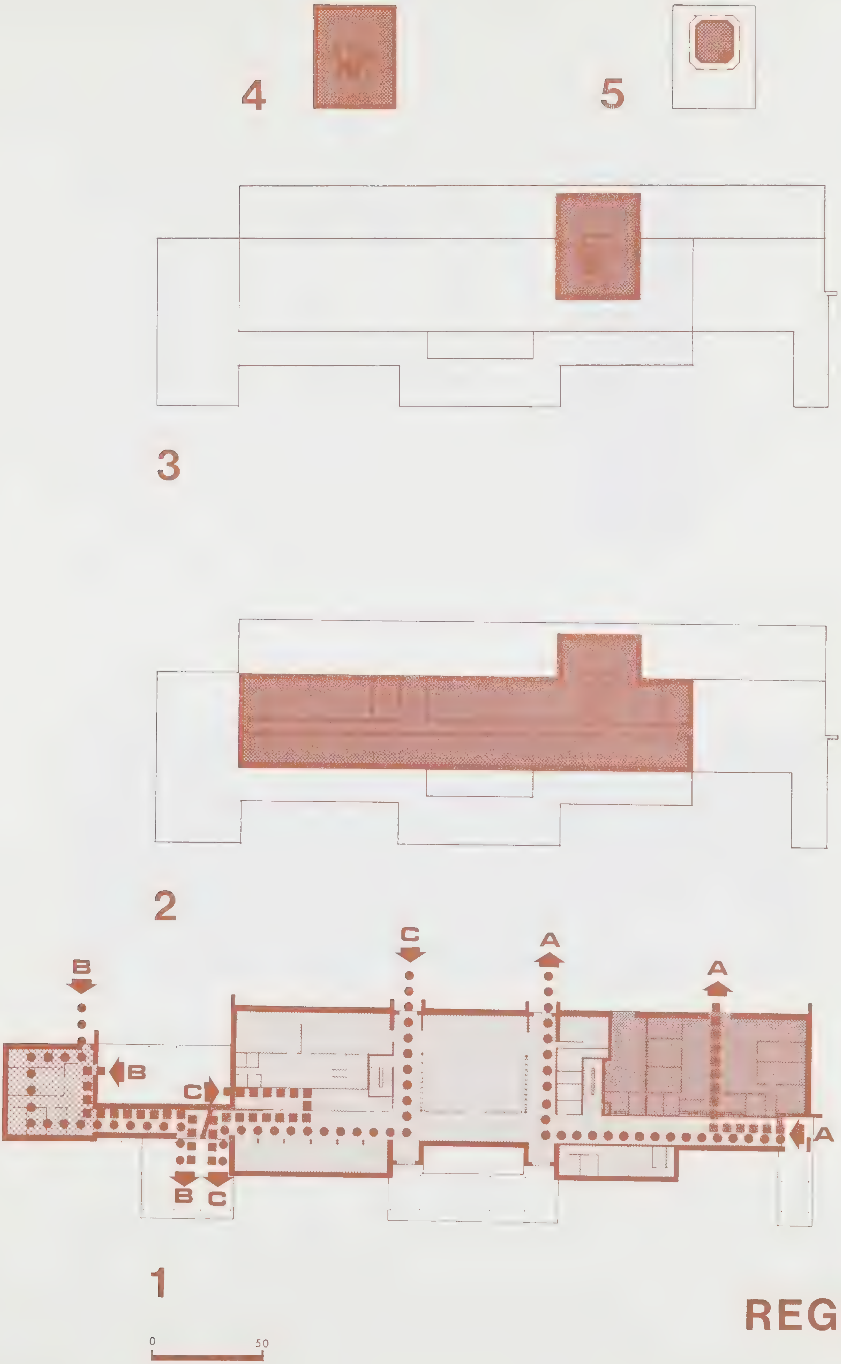


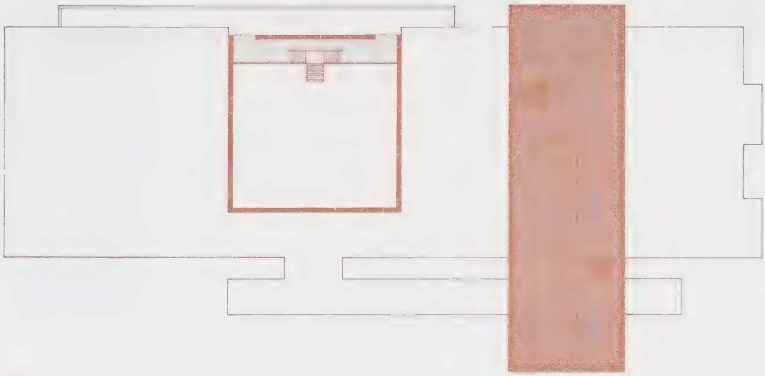
VICTORIA



QUEBEC CITY



REGINA



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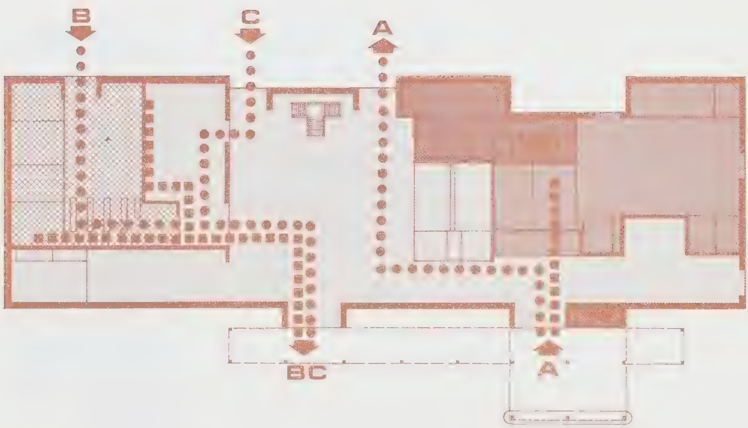

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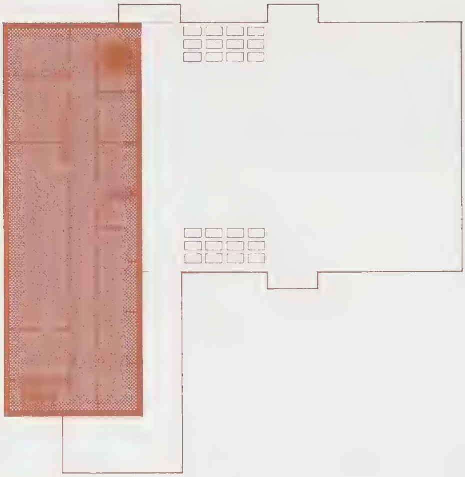
LONDON



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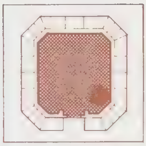
3



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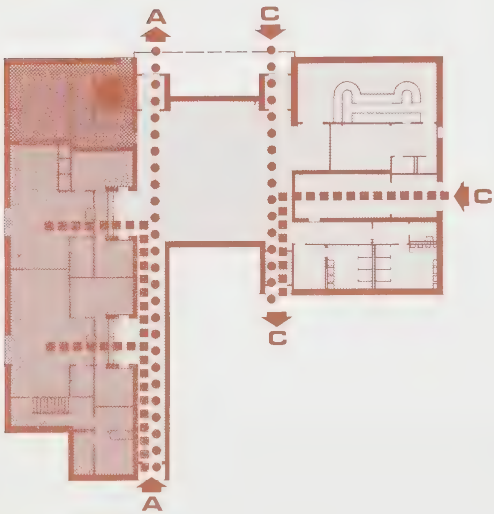

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SEPT ILES

KEY PLANS

This Section contains reproductions of Key Plans prepared from information supplied by the Department of Transport as of 1967. The information for several of the airports is in the process of being updated by the Department, and decisions related to Master Planning Studies executed in 1967 for Montreal, Toronto and Vancouver are not reflected in these reproductions.

KEY PLANS

MONTREAL

TORONTO

VANCOUVER

OTTAWA

HALIFAX

EDMONTON

VICTORIA

QUEBEC CITY

REGINA

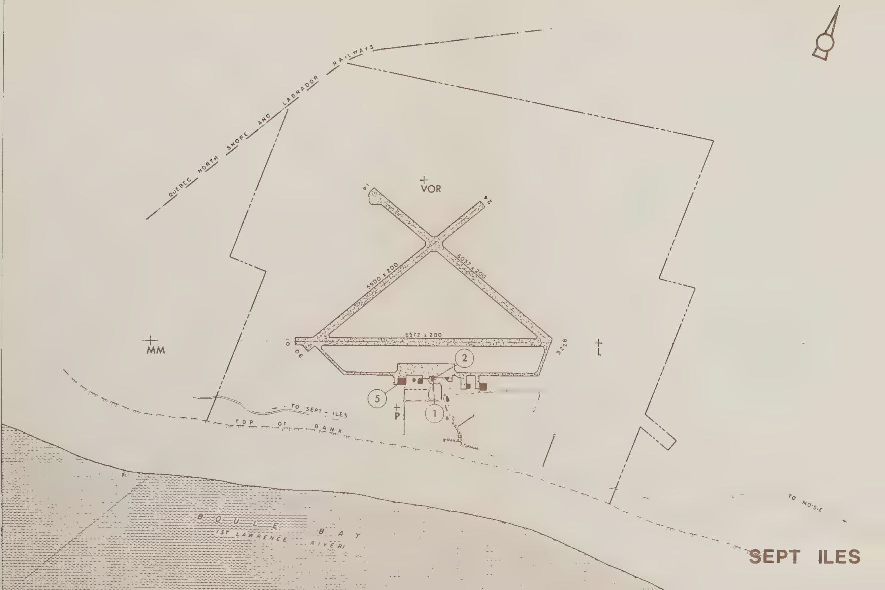
LONDON

LETHBRIDGE

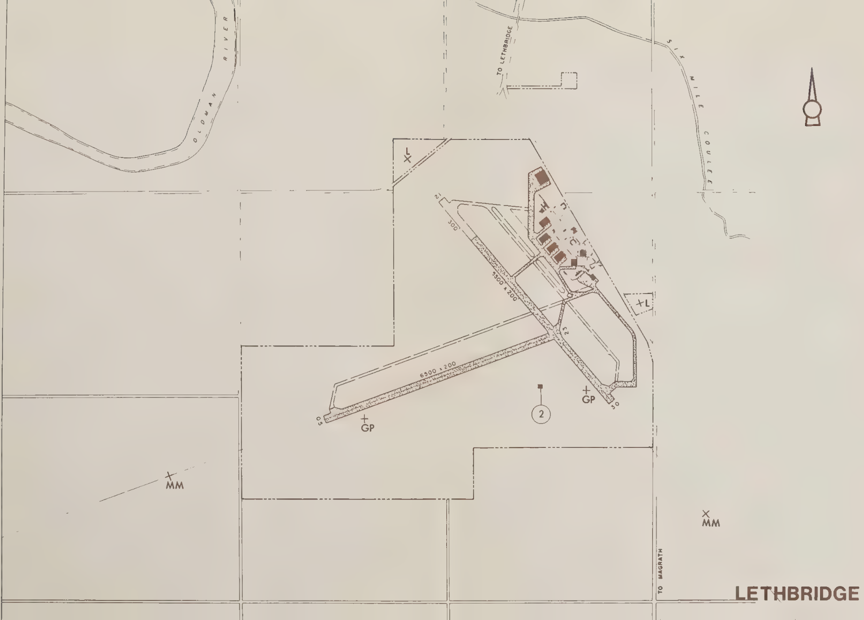
SEPT ILES

LEGEND

TRANSMITTER SITE	TX
RECEIVER SITE	RS
VHF OMNI-DIRECTIONAL RADIO	VOR
AIRPORT SURVEILLANCE RADAR	ASR
AREA/AIRPORT SURVEILLANCE RADAR	AASR
PRECISION APPROACH RADAR	PAR
NON-DIRECTIONAL BEACON	NDB
ILS - MIDDLE MARKER	MM
- GLIDE PATH	GP
- LOCALIZER	L
WEATHER RADAR	WR
TRANSMISSOMETER - PROJECTOR	TP
- DETECTOR	TD
CEILING PROJECTOR	P
CEILOMETER - PROJECTOR	CP
- DETECTOR	CD
ANEMOMETER	A
FUTURE	(F)
PASSENGERS/ADMINISTRATION	1
CONTROL TOWER	2
CARGO	3
DEPARTMENT OF TRANSPORT	4
TENANT	5
BULK FUEL STORAGE	6
FIRE STATION	7


QUEBEC NORTH SHORE AND LABRADOR RAILWAYS
VOR
5900 x 200
6037 x 200
6572 x 200
MM
L
P
TO SEPT - ILES
TOP OF BANK
BOULE BAY
(ST LAWRENCE RIVER)
TO MOISIE

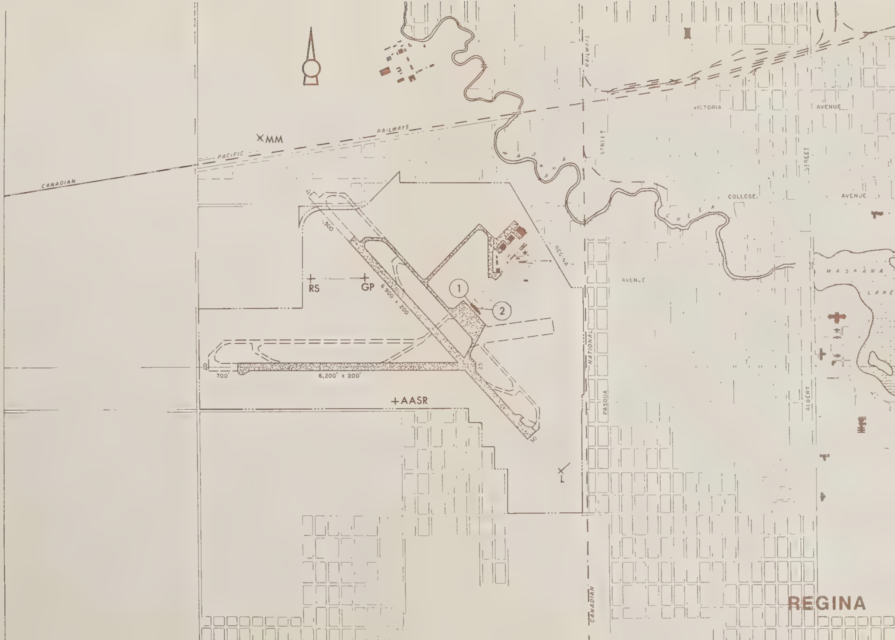
SEPT ILES



OLDMAN RIVER
TO LETHBRIDGE
SIX MILE COULEE
L
+L
21
300
5500 x 200
6500 x 200
23
05
30
GP
GP
2
MM
MM
TO MAGRATH

LETHBRIDGE

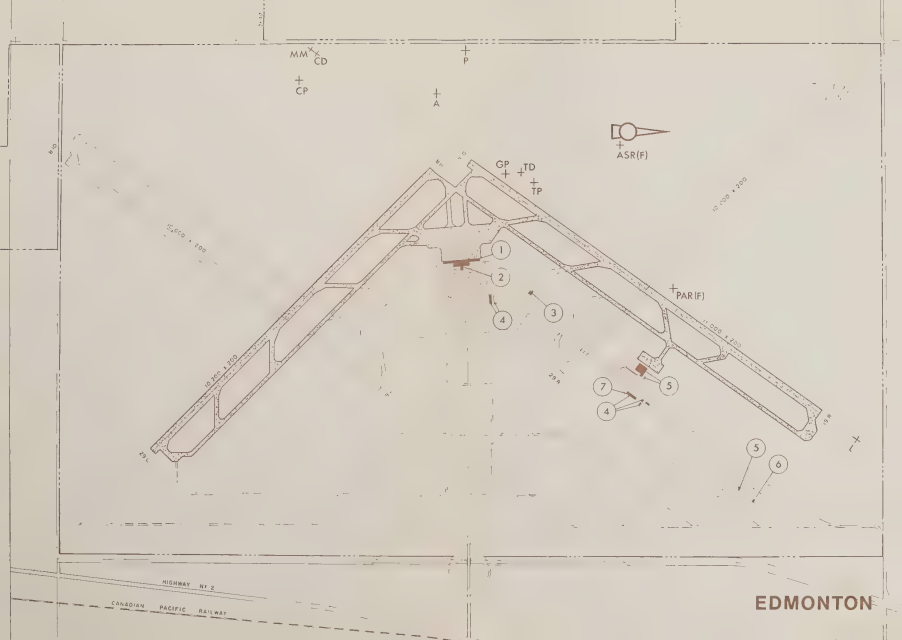

THAMES RIVER
MM
GP
GP(F)
MM(F)
A
5200' x 200'
VOR
6000 x 200
L(F)
4445 x 50
A(F)
TX
WR
TO LONDON
CANADIAN NATIONAL RAILWAYS
P
L
CANADIAN PACIFIC RAILWAYS
LONDON

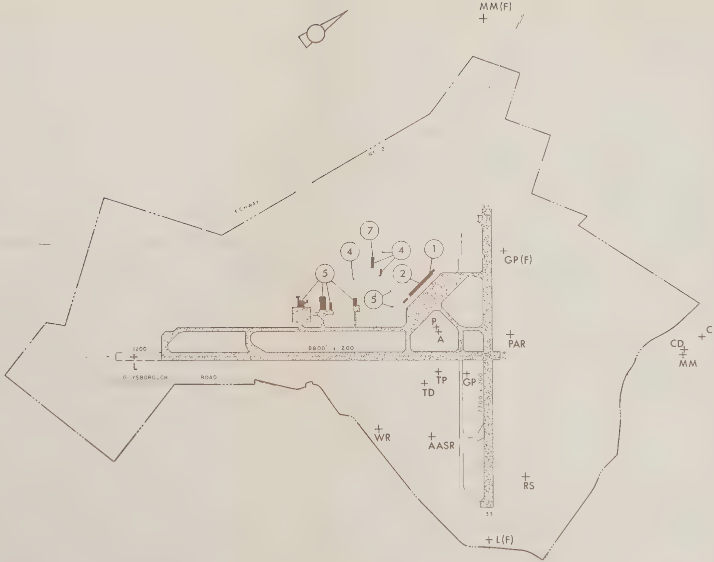


XMM
CANADIAN
PACIFIC
RAILWAYS
RS
GP
6,900' x 200'
6,200' x 200'
700'
+AASR
L
1
2
REGINA
VICTORIA
AVENUE
COLLEGE
AVENUE
STREET
STREET
AVENUE
ALBERT
PASQUA
NATIONAL
CANADIAN
WASKANA
LAKE
CREEK

ANCIENNE LORETTE
LORETTE RIVER
AASR
L
TX
GP
A
P
TP(F)
TD(F)
GP(F)
6000 x 150
5700 x 150
2950 x 150
3000 x 200
WR
MM
MM(F)
1
2
4
5
7
CHAMPIGNY
TO QUEBEC
C P R
TELEPHONE
QUEBEC VIA STE FOY
SHAWINIGAN WATER & POWER CO
C N R
TO TROIS-RIVIERES & MONTREAL
CAP ROUGE RIVER
QUEBEC


TSEHUM HARBOUR
TOWNER PARK ROAD
UNION BAY
INDIAN RESERVE Nº4
ROBERTS
BAY
PATRICIA
BAY
WILSON ROAD
SIDNE
5
L
GP
TP(F)
TD(F)
GP(F)
7
5
A(F)
2
1
5
4
P
MM & NDB
5
1
WELLINGTON ROAD
SAANICH
FALKIRK AVE
WEILER
DALKEITH AVE
FRIZELL ROAD
CRESSWELL ROAD
Mc TAVISH ROAD
BAZAN
BAY
COLE BAY
VICTORIA


MM
CD
P
CP
A
ASR(F)
GP
TD
TP
PAR(F)
1
2
3
4
5
6
7
10 200 x 200
11 000 x 200
29L
29R
19R
HIGHWAY No 2
CANADIAN PACIFIC RAILWAY
EDMONTON


MM(F)
7
4
4
1
5
2
5
GP(F)
P
A
PAR
CP
CD
MM
1200
L
8800' x 200
ROAD
TP
TD
GP
WR
AASR
RS
L(F)
33

HALIFAX

OTTAWA
DND
CANADIAN PACIFIC RAILWAYS
ALBION ROAD
McCARTHY ROAD
HUNT CLUB ROAD
RIVERSIDE DRIVE
RIDEAU RIVER AND CANAL
PRESCOTT HIGHWAY 16
CANADIAN NATIONAL RAILWAYS
CNR
HEPC
BOWESVILLE
PINE ROAD
LIMEBANK ROAD
MERIVALE ROAD
10,000' x 200'
AASR
RS
TP
TD
CP
CD
GP(F)
A
VOR
GP
TX
MM
L (F)
L
P


IONA ISLAND
NORTH ARM
RICHMOND DIST MUN
SEA ISLAND
OAK PARK
RIVERVIEW PARK
MARPOLE
FRASER RIVER
MM(F)
GP(F)
10,800' x 200'
L(F)
A(F)
7
2
1
RS
RS
CP
TP
CD
MM & NDB
GP
TD
PAR
A
5
4
TX
GP
10,600' x 200'
ASR
AASR
Swishwashi Island
VR
P
1
1
4
5
6
4
3
P
MIDDLE
ARM
VANCOUVER


RS
MM
5
1
4
TX
GP
7200 x 200
TP
CP
TD
CD
PAR
28
L
VOR
6
3
A
4300
AASR
P
2
7
MM
GP(F)
Etobicoke
Creek
WR
ASR
TP(F)
TD(F)
9500 x 200
Malton
Road
Theatre
TORONTO

MONTREAL
BOULEVARD
METROPOLITAN
C N R
AASR
Chemin St Francois
Cote De La Vertu Road
Montée De Liesse
24R
24L
11,000 x 200
12,000' x 200'
9,600 x 200
7,000' x 200'
06L
06R
L
L(F)
RS
ASR
PAR(F)
A(F)
TP
A
TD
GP
GP(F)
GP
PAR
MM
CP
CD
MM
MM(F)
P
Cote de Liesse Road
CANADIAN NATIONAL RAILWAYS
CANADIAN RAILWAYS
VALOIS BAY

CANADIAN PROJECTS OVERSEAS

6000

OUTLINE

This Section contains brief descriptions of the three major airport projects overseas in which Canadian capabilities have been involved.

There has been no attempt made in this first issue of the Planning Guide to list all of the Canadian manufactured airport equipment items and aircraft which have been and are being exported. An examination of the Airports for Export Catalogue will provide some information on the inroads into the international market which have been made by Canadian airport equipment manufacturers. Suffice it to say that it is anticipated that such inroads can be increased as more Canadian design capability is utilised overseas, and as the feasibility of design/construction/equipment packages for some countries is investigated.

The three projects described herein cover airport development at Katunayake in Ceylon, and in the Trucial States Sheikdom of Abu Dhabi; and the study for a new intercontinental airport in Brazil.

It is proposed that this Section will be updated with information in greater detail of Canadian efforts overseas, in order to provide increased background material for those involved in contract acquisition in the international market.

KATUNAYAKE

Early in 1964, resulting from a request by the External Aid Office of the Canadian Department of External Affairs to the Construction Branch of the Department of Transport to undertake an engineering study into the airport facility requirements at Katunayake, a report was submitted containing recommendations and cost estimates.

Subsequently a decision was made concerning the full extent of the facilities to be provided for the Ceylonese Government under the Canadian External Aid Programme.

The project has been designed and constructed by Canadians working closely with the Department of Transport.

The supervision of the runway construction, and the design and supervision services on the structural, mechanical and electrical features of the Terminal Building were the responsibilities of Foundation of Canada Engineering Corporation Limited (FENCO).

Tallman Construction Limited, one of the British-American Construction and Materials Ltd. group, constructed the runway extension and overlay 11,050 feet long by 150 feet wide. The runway system is complete with overshoots 200 feet long, paved shoulders 25 feet wide and taxiway providing access to the new parking apron which is 700 feet by 400 feet.

Other installations include high intensity runway lighting, taxiway and apron lighting and power distribution systems.

The terminal building is designed to handle passenger volumes up to 150 TPHP.

ABU DHABI

With the advent of large-scale oil operations in the Trucial States Sheikdom of Abu Dhabi, Sheikh Shakbut, Ruler of Abu Dhabi, decided in late 1965 that his country should join the other developing nations of the Middle East in providing an airport for the transportation to and from the country of passengers and cargo.

Abu Dhabi has the fourth largest proven oil reserves in the Middle East. Forecasts indicate that passengers and freight volumes would reach figures comparable to the airport operation at Kuwait soon after the opening of an airport.

The Ruler retained CANSULT Limited, a Canadian consortium of consulting engineering firms to design the airport in its entirety - from initial surveys and site investigations to eventually the choice of fittings and artwork in the terminal building.

The airport construction was divided into two general contracts.

Phase I, including earthworks, runway, taxiway and apron construction, etc., was awarded to Pauling(Middle East) Limited of the United Kingdom, for $5,800,000. Phase II, including the Terminal and Ancillary Buildings, runway, approach and taxiway lighting, navigational aids, telecommunications, etc., was awarded to a Swedish/Lebanese Joint-Venture named SKANSKA/ Kettaneh for $6,800,000. This contract was commenced in mid-1967 and progress has been somewhat hampered by the closure of the Suez Canal as a result of the Arab-Israeli conflict.

The climatic conditions are hot and dry, with average temperatures ranging from average minimum of 45°F to average maximum of 112°F, and an average annual rainfall of 4.5 inches.

The airport is situated in desert terrain some eight miles from Abu Dhabi Town. The population of the area served numbers approximately 30,000.

The single runway, 31/13, is 10,300 feet in length, and 150 feet wide. The taxiway and the apron are designed for 300,000 pound bearing capacity.

Navigational Aids programmed include VOR and NDB's in 1970, and ILS in 1972.

Lighting Aids programmed for 1970 include Calvert Approach (Cat. 1) and Simple Approach (Cat.1), VASIS, and Runway Centre Line and Edge Lighting.

The reinforced concrete, air conditioned passenger terminal building is 450 feet long by 70 feet wide, and is designed to handle passenger volumes to 150 TPHP. The total allocated floor area comprises some 50,000 square feet.

The project is financed entirely by the Ruler of the State of Abu Dhabi.

BRAZIL

In June 1967 the Government of Brazil issued a Decree creating in the Air Ministry, directly subordinated to the Air Minister, a Co-ordinating Commission charged with the responsibility of an International Airport Project for Brazil.

The Project was to consist of three phases, all to be contracted with specialised firms.

Phase I - a technical and economic feasibility study
Phase 2 - the preparation of plans for execution
Phase 3 - the construction of the Airport

The estimated total capital cost for the complete Project is $100,000,000.

At the time the Co-ordinating Commission was created and the Basic Rules for the execution of the project were published, a Canadian Trade Mission was in Brazil as part of the Airports for Export programme initiated by the Department of Trade and Commerce and the Airport Export Committee.

Canadian consultants were apprised of the project and subsequently two consortiums of consultants from Canada associated themselves with prequalified Brazilian firms to enter the international competition for Phase I.

Proposals were submitted and the contract for the execution of Phase I was awarded to H. G. Acres Ltd. and John B. Parkin Associates in consortium with Hidroservice of Sao Paolo.

PHOTOGRAPHS

7000

OUTLINE

This Section comprises a selection of photographs of buildings and equipment installations at airports covered in the Canadian Airports Analysis sections and of STOL aircraft manufactured in Canada.

Information concerning individual equipment items, together with photographs, is contained in the "Airports for Export" Catalogue which supplements the Planning Guide.

Aeroquay at Toronto International Airport.

CANADIAN AIRPORTS

Terminal Building, Montreal International Airport.

Control Tower, Montreal International Airport.

Control Tower and Air Traffic Control Building at Toronto International Airport.

A departure room in Aeroquay at Toronto International Airport.

Aeroquay at Toronto showing seven storey 2400 Car Parking Garage.

Control Tower, Vancouver International Airport.

Terminal Building, Vancouver International Airport.

Terminal Building, Ottawa International Airport.

Passenger Lounge, Ottawa International Airport Terminal.

Terminal Building, Halifax International Airport.

Terminal Building, Edmonton International Airport.

Terminal Building, Victoria Airport.

Terminal Building, Quebec Airport.

Regina Municipal Airport Terminal.

London Airport Terminal.

TYPICAL INSTALLATIONS

Separate power plant at Edmonton International Airport serves terminal building with light, heat, air-conditioning and standby power.

TYPICAL INSTALLATIONS

Outer Marker showing typical Marker/Compass Locator configuration of ILS system.

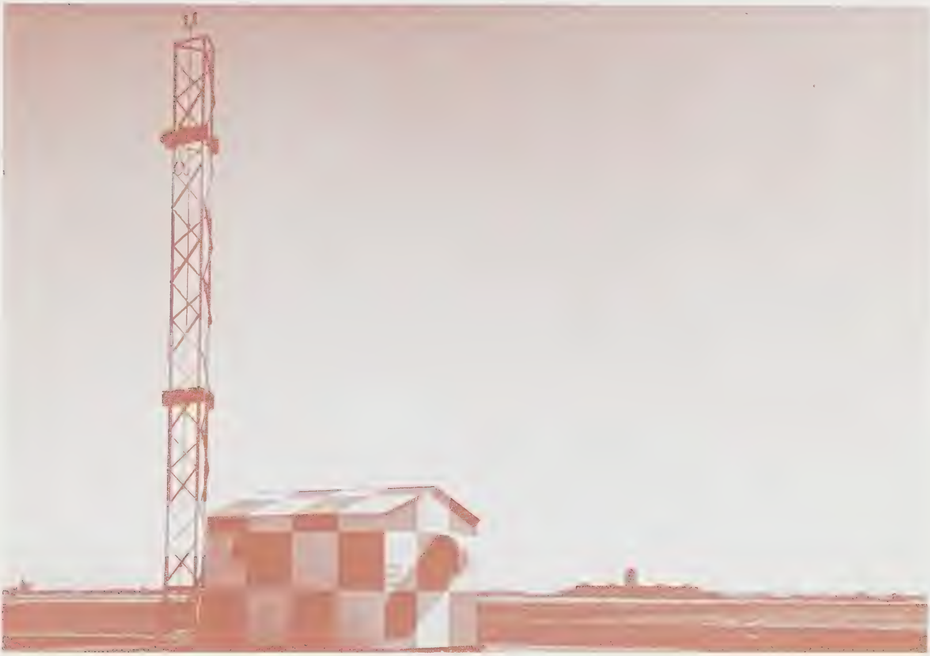
TYPICAL INSTALLATIONS

Remote Receiver Site housing majority of air/ground HF, VHF, and UHF receiving equipment.

TYPICAL INSTALLATIONS

VOR/TACAN Building

TYPICAL INSTALLATIONS

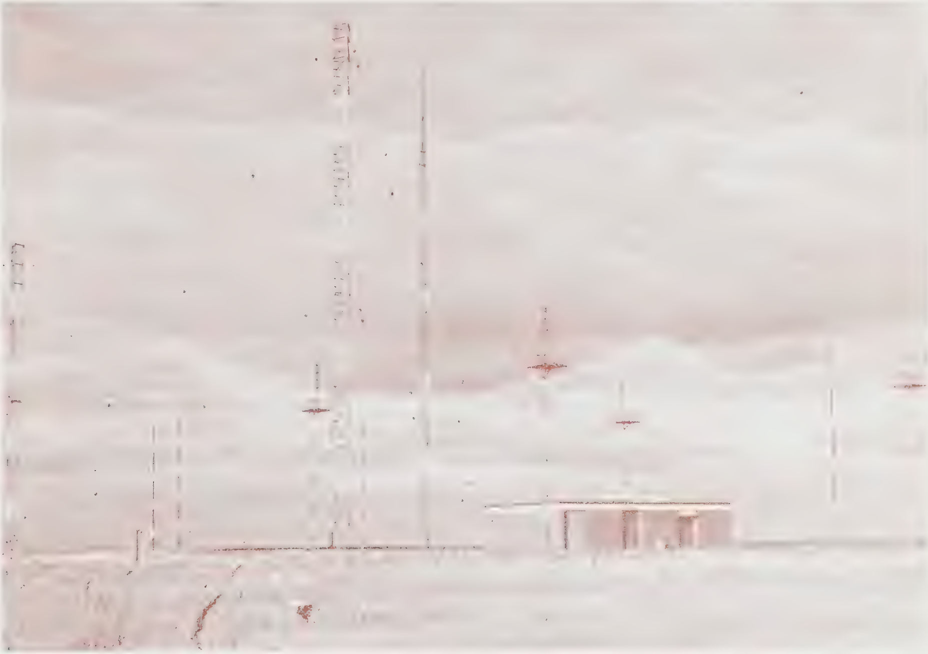


Glide path building and equipment installation.

TYPICAL INSTALLATIONS

Low Frequency Radio Range installation.

TYPICAL INSTALLATIONS



Remote Transmitter Site housing majority of air/ground LF, HF, VHF, and UHF transmitting equipment.

TYPICAL INSTALLATIONS

AASR-1 Equipment Complex, with "no-break" power plant in building at right.

TYPICAL INSTALLATIONS

ILS Localiser installation showing offset equipment building at right, and eight-loop localizer antenna structure.

TYPICAL EQUIPMENT

Typical snow removal operation.

TYPICAL EQUIPMENT

Rotating luggage dispensers.

Aeradio position, showing Tacan Monitor, VOR control, ILS control, LFR control, communications modules, miscellaneous control, Eppi Indicators, Floater Receiver and telephone control panel.

TYPICAL EQUIPMENT

Marine/Aeradio positions showing Marine to the left and Aeradio to the right.

TYPICAL EQUIPMENT

Terminal Control, showing Arrival position on Left and Departure on Right.

TYPICAL EQUIPMENT

Equipment Room showing Ancillary Control Rack, Standby Receivers, Standby Transmitters, Navaids Control and VOR Tone Control Rack.

TYPICAL EQUIPMENT

Control Tower, Ground Control and Airport Control showing Communications Equipment, Supervisors Indicating Panel, Field Lighting, Wind Equipment and Altimeter.

STOL AIRCRAFT

There are many types of aircraft manufactured today for conventional air transport operations. However, old problems still exist. The lack of, and difficulty in cost and construction of lengthy runways prohibits the development of air transport into many areas where it is urgently needed. New problems are evolving in densely populated areas where ground congestion, airways congestion and the high cost and lack of suitable real estate are throttling overall transport systems. VTOL and STOL vehicles, because of their minimal airfield requirements, offer a solution to land and construction problems. STOL aircraft (fixed Short Take-off and Landing) offer operating economics comparable to conventional aircraft.

Manufactured in Canada is a range of economic, simple and effective STOL aircraft:

DHC-6 Twin Otter

Weight	12,500 lb.
Passengers	20
Cargo	5,300 lb.
Range	700 NM,
Speed	177 kts

2 x PT6A-27 United Aircraft of Canada engines

DHC-4 Caribou

Weight	28,500 lb.
Passengers	30
Cargo	8,600 lb.
Range	900 NM,
Speed	157 kts

2 x R-2000 Pratt & Whitney engines

DHC-5 Buffalo

Weight	41,000 lb.
Passengers	47
Cargo	14,000 lb.
Range	1,500 NM,
Speed	245 kts

2 x CT64-820-2 General Electric engines

STOL APPLICATION

The de Havilland STOL aircraft can operate:

- from short strips
- from natural ground (CBR-2.5)
- at low take-off and landing speeds
- with steep approach and climb gradients and in smaller traffic patterns

The STOL characteristics permit operations:

- in bush or undeveloped regions
- into rudimentary airstrips
- into areas considered hazardous to conventional aircraft
- providing conventional service from existing small fields
- to open up undeveloped regions
- to overcome ground transport problems

or in densely populated, industrial or urban areas:

- to provide local short stage services
- commuter or feeder operations
- to operate out of main ATC control patterns at major airports
- to provide airport-downtown services
- to provide downtown to downtown services

APPENDICES

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OUTLINE

This section contains supplementary material which will be updated from time to time.

APPENDIX A — Company Listings of Canadian Consultants, Contractors, and Equipment Manufacturers.

APPENDIX B — "Aviation Systems Approach to Master Planning" - a description of the approach presented by the Department of Transport.

APPENDIX C — "Scope of Work to Develop a Master Plan Report" - as prepared by the Department of Transport.

APPENDIX D — Specification References - a short list of operational requirement specifications referred to in the Design Checklists. (This list can be expanded to suit specific practice.)

APPENDIX E — Bibliography - a partial list of publications utilised during the preparation of the Planning Guide.

APPENDIX F — Excerpts from the Audio-Visual Supplement "Airports for Export from Canada" - a 30 minute taped/slide presentation available from the Department of Trade and Commerce. Included in this appendix are black-and-white reproductions of a number of pertinent graphics together with the appropriate excerpts from the script.

COMPANY LISTINGS - CONSULTANTS

1.00 A

.01 ACRES INTERTEL LIMITED
298 Elgin Street, Ottawa 4, Ontario

.02 ACRES LIMITED
The National Trust Building, 7 King Street East, Toronto 1, Ontario.

2.00 B

.01 BEAUCHEMIN - BEATON - LAPOINTE (member of CANSULT)
6655 Cote des Neiges Road, Montreal 26, Quebec

3.00 C

.01 CANCON CANADIAN ENGINEERING SERVICES LTD.
1415-409 Granville Street, Vancouver 2, British Columbia.

.02 CANSULT LIMITED - Canadian Consortium of Consulting Engineers
75 Albert Street, Ottawa 4, Ontario.

4.00 D

.01 DAMAS AND SMITH LIMITED
10 Codeco Court, Don Mills, Ontario.

.02 DAMES & MOORE LIMITED
111 Railside Road, Suite 205, Don Mills, (Toronto), Ontario.

.03 DELEUW, CATHER & ASSOCIATES
50 Place Crémazie, No. 427, Montreal 11, Quebec.

.04 M.M. DILLON LIMITED
141 Maple Street, London, Ontario.

.05 R. DIXON SPEAS ASSOCIATES OF CANADA LIMITED
800 Dorchester West, Montreal, Quebec.

5.00 E

.01 EDMONTON CONSULTING ASSOCIATES, LTD.
1400 Royal Bank Bldg., 10117 Jasper Avenue, Edmonton, Alberta.

COMPANY LISTINGS - CONSULTANTS

6.00 F

.01 NICHOLAS FODOR & ASSOCIATES LIMITED (member of CANSULT)
35 Charles Street East, Toronto 5, Ontario.

.02 FORRESTER, SCOTT, BOWERS, COOPER
1120 Morgan Avenue, Saskatoon, Saskatchewan

.03 FOUNDATION OF CANADA ENGINEERING CORPORATION LTD.
2200 Yonge Street, Toronto 12, Ontario.

7.00 G

.01 GENDRON, LEFEBVRE & ASSOCIES
1 Place Laval, Room 200, City of Laval, Quebec.

.02 GENERAL ENGINEERING COMPANY LIMITED
100 Adelaide Street West, Toronto 1, Ontario.

.03 H. Q. GOLDER & ASSOCIATES LIMITED
3151 Wharton Way, Cooksville, Ontario.

8.00 H

.01 PER HALL ASSOCIATES
1980 Sherbrooke Street West, Montreal 25, Quebec.

.02 HOYLES, NIBLOCK AND ASSOCIATES
3110 Boundary Road, Vancouver 12, British Columbia.

.03 HOWE INTERNATIONAL LIMITED (C.D. HOWE CO. LTD.)
4333 St. Catherine Street West, Montreal 6, Quebec.

9.00 I 10.00 J

11.00 K

.01 KATES, PEAT, MARWICK & CO.
4 King Street West, Toronto 1, Ontario

.02 KEMBUR ENGINEERING CONSULTANTS LIMITED
521 Memorial Avenue, Port Arthur, Ontario.

COMPANY LISTINGS CONSULTANTS

.03 W. S. KENDALL & ASSOCIATES
77 Metcalfe, Suite 409, Ottawa 4, Ontario.

.04 KILBORN ENGINEERING LTD.
36 Park Lawn Road, Toronto 18, Ontario

12.00 L

.01 N. D. LEA & ASSOCIATES LTD.
740 Nicola Street, Vancouver 5, British Columbia

13.00 M

.01 JAMES F. MACLAREN LIMITED
321 Bloor Street East, Toronto 5, Ontario.

.02 MARSHALL, MACKLIN MONAGHAN LIMITED (member of CANSULT)
1480 Don Mills Road, Don Mills, Ontario

.03 MCMILLAN, MARTYNOWICZ & BRUCE
5300 Yong Street, Toronto, Ontario.

.04 MENDEL, BRASLOFF, LASSMAN & SIDLER
485 McGill Street, Suite 403, Montreal 1, Quebec.

.05 MONARQUE, MORELLI, GAUDETTE, LAPORTE
6333 Decarie Blvd., Montreal, Quebec.

.06 MORRISON, HERSHFIELD, MILLMAN & HUGGINS, LIMITED
3089 Bathurst Street, Toronto 19, Ontario.

14.00 N

.01 NISBET, LETHAM LIMITED
206 Water Stréet, P. O. Box 51, Sarnia, Ontario.

15.00 O

16.00 P

.01 N. J. PAPPAS AND ASSOCIATES
5253 Decarie Boulevard, Montreal 29, Quebec.

COMPANY LISTINGS - CONSULTANTS

.02 C. C. PARKER AND ASSOCIATES LIMITED
688 Queensdale Avenue East, Hamilton, Ontario

.03 JOHN B. PARKIN ASSOCIATES
1500 Don Mills Road, Postal Station "J", Toronto, Ontario.

.04 PROCTOR & REDFERN INTERNATIONAL LIMITED
75 Eglinton Avenue East, Toronto 12, Ontario.

.05 PROJECT PLANNING ASSOCIATES (INTERNATIONAL) LIMITED
40 Irwin Avenue, Toronto 5, Ontario.

17.00 Q

18.00 R

.01 RACEY, MACCALLUM & BLUTEAU LTD.
5890 Monkland Avenue, Montreal 28, Quebec.

.02 REID, CROWTHER & PARTNERS LIMITED
1134 - 8th Avenue, Southwest, Calgary, Alberta.

.03 J. L. RICHARDS & ASSOCIATES LIMITED
864 Lady Ellen Place, Ottawa 3, Ontario.

19.00 S

.01 STEVENSON & KELLOGG LIMITED
150 Eglinton Avenue East, Toronto, Ontario

.02 SURVEYER, NENNIGER & CHENEVERT INC. (member of CANSULT)
1550 de Maisonneuve Boulevard West, Montreal 25, Quebec.

.03 SWAN WOOSTER ENGINEERING CO. LTD. (member of CANCON)
1525 Robson Street, Vancouver, British Columbia.

20.00 T

.01 TECSULT INTERNATIONAL LIMITED
4200 Dorchester Boulevard West, Montreal 6, Quebec.

.02 TEMPLETON ENGINEERING CO.
528 St. James Street, Winnipeg 10, Manitoba.

COMPANY LISTINGS - CONSULTANTS

21.00 **U**

.01 UNDERWOOD MCLELLAN AND ASSOCIATES
1220 Pembina Highway, Winnipeg 19, Manitoba.

22.00 **V**

23.00 **W**

.01 W. L. WARDROP & ASSOCIATES LTD.
456 Notre Dame Avenue, Winnipeg, Manitoba.

24.00 **X**

25.00 **Y**

26.00 **Z**

COMPANY LISTINGS - GENERAL CONTRACTORS

1.00 A

.01 ATLAS CONSTRUCTION CO. LTD.
4781 St. Catherine Street West, Montreal, Quebec.

.02 THE AUSTIN CO. LTD.
800 Dorchester Boulevard West, Montreal, Quebec.

2.00 B

.01 BEDARD GIRARD LIMITED
230 Nepean Street, Ottawa, Ontario.

.02 BRITISH AMERICAN CONSTRUCTION AND MATERIALS
1500 Plessis Road, Winnipeg, Manitoba.

3.00 C

.01 CANADA ELECTRIC CO. LTD.
2451 Danforth Avenue, Toronto 13, Ontario.

.02 CANADIAN COMSTOCK CO. LTD.
2 St. Claire Avenue, Toronto 7, Ontario.

4.00 D

.01 DIBBLEE CONSTRUCTION CO. LTD.
P. O. Box 4503, Postal Station "E", Ottawa, Ontario.

.02 DUFFERIN MATERIALS & CONSTRUCTION LTD.
2700 Dufferin Street, Toronto 19, Ontario.

.03 DUFRESNE ENGINEERING CO. LTD.
2620 St. Joseph Boulevard West, Montreal 36, Quebec.

5.00 E

6.00 F

.01 THE FOUNDATION COMPANY OF CANADA LTD.
220 Yonge Street, Toronto, Ontario.

COMPANY LISTINGS - GENERAL CONTRACTORS

7.00 **G**

.01 GENERAL STRUCTURES INC.
50 Cremazie Boulevard West, Montreal 11, Quebec.

8.00 **H**

9.00 **I**

.01 INSPIRATION LTD.
6865 Maisonneuve Boulevard, Montreal, Quebec.

10.00 **J** 11.00 **K** 12.00 **L**

13.00 **M**

.01 MANNIX COMPANY LIMITED
815 - 2nd Street, Southwest, Calgary, Alberta.

.02 MCALLISTER CONTRACTING CO. LTD.
103 Water Avenue, Winnipeg, Manitoba.

.03 MIRON COMPANY LTD.
2201 Jarry Street East, Montreal, Quebec.

14.00 **N** 15.00 **O**

16.00 **P**

.01 PYLE-NATIONAL (CANADA) LTD.
2560 South Sheridan Way, Clarkson, Ontario.

17.00 **Q** 18.00 **R**

19.00 **S**

.01 SIROTEK CONSTRUCTION LTD.
1305 Baseline Road, Ottawa, Ontario.

.02 STANDARD GENERAL CONSTRUCTION (INTERNATIONAL) LTD.
Box 5900, Postal Station "A", Calgary, Alberta.

20.00 **T** 21.00 **U** 22.00 **V** 23.00 **W** 24.00 **X** 25.00 **Y** 26.00 **Z**

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

1.00	**A**	
.01	AEROMETALS LTD. 7 King St. E., Toronto, Ont.	refuelling ladders
.02	AEROQUIP (CANADA) LTD. 287 Bridgeland Ave., Toronto 19, Ont.	refuelling hose assemblies
.03	AIR VISION INDUSTRIES INC. P.O. Box 295, Montreal Zone 354, Que.	transportable control towers
.04	ANDREW ANTENNA CO. LTD. P.O. Box 177, Whitby, Ont.	antennae, transmission lines, coaxial / heliax cables
.05	AUTOMATIC ELECTRIC (CANADA) CO. LTD. 100 Stowger Blvd., Brockville, Ont.	telephone comms. eqpt.
.06	AVIATION ELECTRIC LTD. P.O. Box 2140 St. Laurent, Que.	vehicle navigation sets
2.00	**B**	
.01	BEACONING OPTICAL & PRECISION MATERIALS CO. LTD. 455 Craig St. W., Montreal, Que.	eqpt. for airfield lighting, met.,ATC,em. power
.02	BEDARD GIRARD LTD. 117 Lagauchetiere St. W., Montreal, Que.	electrical systems, airport lighting eqpt.
.03	S. F. BOWSER COMPANY LTD. 344 Sherman Ave. N., Hamilton, Ont.	fuel storage eqpt.
.04	W.D. BRENT MFG. LTD. 3272 Elmbank Rd., Malton, Ont.	baggage/cargo containers and pallets
3.00	**C**	
.01	CAE INDUSTRIES LTD. 1 Place Ville Marie, Montreal, Que.	telepath control/telegraph eqpt., weather sat. pict. rec'g.stations
.02	CANADA WIRE & CABLE CO. LTD. P.O. Box Station "R", Toronto 17, Ont.	electrical/electronic wire and cable

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

3.03	CANADAIR LIMITED Laurentian Blvd., St. Laurent, Montreal, Que.	articulated tracked vehicle
.04	CANADIAN CONTROLLERS LTD. 1550 Birchmount Rd., Scarborough, Ont.	electrical motor controls
.05	CANADIAN GENERAL ELECTRIC CO. LTD. 214 King St. W., Toronto, Ont.	vhf a-gd-a comms., a-v multi-plexer, video integrator/mapper
.06	CANADIAN MARCONI CO. 2442 Trenton Ave., Montreal, Que.	airborne comms., hf ssb comms.
.07	CANADIAN MOBILE CO. LTD. 2033 Logan, Langley, B.C.	fd. serv. trucks, tractors, self-propelled baggage/cargo handlers
.08	CANADIAN VICKERS LTD. 4970 Notre Dame St. E., Montreal, Que.	moving sidewalks, escalators
.09	CANADIAN WESTINGHOUSE INTERNATIONAL CO. 840 York Mills Rd., Don Mills, Ont.	airport lighting/electrical systems
.10	CENTRAL DYNAMICS LTD 147 Hymus Blvd., Pointe Claire, Que.	information display systems
.11	CENTURY AIR-GROUND SERVICES LTD. 3160 Sartelon St., Montreal 9, Que.	aircraft starters, calibration eqpt.
.12	CLARK EQUIPMENT OF CANADA LTD. Michigan Blvd., St. Thomas, Ont.	forklifts, straddle/van carriers
.13	COLLINS RADIO COMPANY OF CANADA LTD. 150 Bartley Dr., Toronto, Ont.	vhf, lf, hf ssb comms., mobile comms. eqpt.
.14	COMPUTING DEVICES OF CANADA LTD. Box 508, Ottawa, Ont.	eqpt. for comms./air navigation, recording devices
.15	CROUSE HINDS CO. OF CANADA LTD. 1160 Birchmount Rd., Scarborough, Ont.	eqpt. for airport lighting/ electrical distribution

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

4.00 D

.01	DEUTZ-DIESEL (CANADA) LTD. 90 Montee de Liesse, St. Laurent, Que.	emergency generating units
.02	DOMINION ALUMINUM FABRICATING LTD. 36 Coronet Rd., Toronto 18, Ont.	baggage/cargo containers/trucks
.03	DUSTBANE ENTERPRISES LTD. 25 Pickering Pl., Ottawa 2, Ont.	cleaning eqpt.

5.00 E

.01	ELECTRO-VOX INDUSTRIES LTD. 2626 Baker Rd., Montreal 26, Que.	intercom. eqpt.
.02	EMCO LTD. 1108 Dundas St. E, London, Ont.	fuelling systems, pipes, valves, fittings
.03	ESNA LTD. P.O. Box 250, Agincourt, Ont.	runway ltg./electrical eqpt., underground isolating transformers

6.00 F

.01	FEDERAL PACIFIC ELECTRIC OF CANADA 19 Waterman Ave., Toronto 16, Ont.	power distribution eqpt., heating cables, heaters
.02	FERRANTI-PACKARD ELECTRIC LTD. 121 Industry St., Toronto 15, Ont.	flight information systems, reservation systems

7.00 G

.01	GARRETT MANUFACTURING LTD. 255 Attwell Dr., Rexdale, Ont.	mesometeorological data acq. system
.02	GO-TRACT LIMITED P.O. Box 600, St. Anne de Bellevue, Que.	tracked crash/rescue vehicles, fire fighting eqpt.
.03	GORMAN-RUPP OF CANADA LTD 70 Burwell Rd., St. Thomas, Ont.	pumps

8.00 H

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

9.00	**I**	
.01	INDUSTRIAL WIRE AND CABLE CO. LTD. Index Rd., Toronto 18, Ont.	wire and cable
10.00	**J**	
11.00	**K**	
.01	GEORGE KELK LTD. 48 Lesmill Rd., Don Mills, Ont.	electrical eqpt.
.02	KING SEAGRAVE LTD. 873 Devonshire Ave., Woodstock, Ont.	fire engines
12.00	**L**	
.01	LENKURT ELECTRIC CO. OF CANADA LTD. 7018 Lougheed Hwy., Burnaby 2, B.C.	vhf, uhf radio telephone eqpt., telegraph/data transmission eqpt., multiplex eqpt.
.02	LITTON SYSTEMS (CANADA) LTD. 25 Cityview Dr., Rexdale, Ont.	rvr computers
13.00	**M**	
.01	MARITIME INDUSTRIES LTD. 445 West 6th Ave., Vancouver 10, B. C.	lifter platforms, aux. power units, service vehicles
.02	MARSLAND ENGINEERING LTD. 350 Weber St. N, Waterloo, Ont.	ground control eqpt., transmiss-ometers, rvr computers, ceilometers
.03	MATHEW MOODY LTD. P.O. Box 120, Terrebonne, Que.	baggage/cargo lifting/handling trucks
.04	MATHEWS CONVEYOR CO. LTD. Hwy. No. 2 E, Port Hope, Ont.	baggage/cargo handling eqpt.
.05	MCGRAW-EDISON (CANADA) LTD. 3595 St. Claire Ave. E, Scarborough, Ont.	electrical systems, vasis, regulator switchboards

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

13.06	MEASUREMENT ENGINEERING LTD. P.O. Box 850, Arnprior, Ont.	electrical/electronic eqpt., control tower consoles, public address systems
.07	MECHRON ENGINEERING PRODUCTS LTD. 2437 Kaladar Ave., Ottawa 8, Ont.	custom-built eqpt. for power generation, and control panels
.08	MILLARD ELECTRIC LTD. Dufferin St., Perth, Ont.	visual aids/comms. towers/masts, ancillaries
.09	MITCHELL, ROBERT CO., LTD. 350 Decarie Blvd., St. Laurent, Montreal 9, Que.	conveyors, loading bridges
14.00	**N**	
.01	NORTHERN ELECTRIC COMPANY LTD. 1600 Dorchester Blvd. W, Montreal, Que.	comms. eqpt., wire and cable
.02	NORTHERN RADIO MANUFACTURING CO. LTD. 1950 Bank St., Ottawa 10, Ont.	comm. control eqpt. for aeradio/air traffic control
.03	NORTHWEST INDUSTRIES LTD. P.O. Box 517, Edmonton, Alta.	ground handling equipment
15.00	**O**	
.01	OTIS ELEVATOR CO. LTD. 414 Victoria Ave. N, Hamilton, Ont.	elevators
16.00	**P**	
.01	PHILIPS ELECTRONIC INDUSTRIES LTD. 116 Vanderhoof Ave., Toronto 17, Ont.	atc comms, radio beacons, atc consoles
.02	PIRELLI CABLES LTD. 77 Richelieu St., St. Johns, Que.	wire and cable
.03	PUROLATOR PRODUCTS (CANADA) LTD. 1180 Lakeshore Rd. E., Port Credit, Ont.	eqpt. for fuel storage/servicing facilities
.04	PYLE-NATIONAL CANADA LTD. 2560 S. Sheridan Way, Clarkson, Ont.	eqpt. for lighting/electrical, heating/ventilation

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

16.05	PYRENE MANUFACTURING CO. OF CANADA LTD. 777 Dundas St., Toronto, Ont.	crash trucks
.06	PYROTENAX OF CANADA LTD. 250 West St., Trenton, Ont.	power/heating cables, electrical systems
17.00	**Q**	
18.00	**R**	
.01	RAYTHEON CANADA LTD. 400 Phillip St., Waterloo, Ont.	comms. eqpt., information display system, radar, vor, beacons/other navaids
.02	RCA VICTOR COMPANY LTD. 1001 Lenoir St., Montreal 30, Que.	microwave comms. systems, information display systems
19.00	**S**	
.01	SICARD INC. 10 Sicard St., Ste. Therese, Que.	runway snow removal/crash/rescue/fire fighting eqpt.
.02	SINCLAIR RADIO LABORATORIES LTD. 21 Toro Rd., Downsview, Ont.	comms. eqpt. and ancillaries
.03	SKYKEESH INDUSTRIES LTD. P.O. Box 461, Vankleek Hill, Ont.	transportable control towers
.04	SPILSBURY AND TINDALL SALES LTD. 120 E. Cordova St., Vancouver 4, B. C.	comms. eqpt. and ancillaries
20.00	**T**	
01	TMC (CANADA) LTD. R. R. #5, Ottawa, Ont.	vlf, lf, hf ssb comms. eqpt.
.02	PIERRE THIBAULT CANADA LTD. Pierreville, Que.	fire trucks and eqpt.
.03	TIMMINS AVIATION MANUFACTURING LTD. Montreal Int'l. Airport, Dorval, Que.	aircraft food service systems/toilets/coatrooms, cargo containers

COMPANY LISTINGS - EQUIPMENT MANUFACTURERS

20.04	TOLEDO SCALE COMPANY OF CANADA LTD. 2462 Howard Ave., Windsor, Ont.	weighing machines
.05	TOPPING ELECTRONICS LTD. 94 Laird Dr., Toronto 17, Ont.	comms. eqpt. and ancillaries
.06	TRUCK ENGINEERING LTD. 165 Wellington St. S, Woodstock, Ont.	fire engines
.07	TRUMP HYDRAULIC LTD. 12 Davidson Rd., Brampton, Ont.	hydraulic boom aircraft ramp de-icers
21.00	U	
22.00	V	
23.00	W	
.01	WARDAIR CANADA LTD. Edmonton Int'l. Airport, Edmonton, Alta.	ladders, ramps, platform lifters, self-propelled passenger stairs
.02	WILLOCK TRUCK EQUIPMENT CO. LTD. 205 W 2nd St., Vancouver, B. C.	baggage transport eqpt., food vans, refuellers/tank trailers
24.00	X	
25.00	Y	
26.00	Z	

THE AVIATION SYSTEMS APPROACH TO AIRPORT PLANNING

AVIATION SYSTEMS PLANNING GROUP,

DEPARTMENT OF TRANSPORT, JULY 14, 1967

I N D E X

ABSTRACT

The future development of Canada depends to a great extent upon a well-developed air transportation system. Airports form a most important part of this system.

The Department of Transport has developed methods and procedures for the long-range planning of airports. These are included in the aviation systems approach to planning, wherein all systems on an airport are integrated into an overall balanced concept for the following twenty year period. The aviation systems method of planning may be applied to any airport from the smallest to the largest.

The aviation systems approach to airport planning has been designed to fit Canadian circumstances. Planning authorities in other countries may find that, with some changes to suit their particular circumstances, this planning method would be equally effective when related to their planning problems.

INTRODUCTION

Canada depends to a large extent upon its air transportation system to effectively tie together the many communities lying across the 4,000,000 square miles that constitute the land mass. Today air transportation ties the country together as did the railways after the Confederation of Canada in 1867.

There is a total of 1,575 airports or seaplane bases in Canada. This number is made up of licensed or unlicensed civil facilities, plus a number of military airports. There are 105 mainline airports, sixty of the largest being operated and maintained by the Department of Transport. The mainline airports serve almost all of the public who travel by airline.

In order to exercise effective control over civil aviation in Canada, the country is divided into six regions, the headquarters of which are located at Vancouver, Edmonton, Winnipeg, Toronto Montreal and Moncton. The functional control of day-to-day operations is decentralized to the Regions. The responsibility for the long-range planning of aviation and for tying airports together into an effective system is maintained at the Department of Transport Headquarters in Ottawa. Departmental planners, realizing that airports of the future must be designed as complete systems integrating related ground access, land use, urban development and interfacing transportation requirements, have initiated a system of planning for airports known as "aviation systems planning".

PLANNING APPROACH

"Aviation Systems" is defined as all the component parts and operating elements that make up the total air transportation system. Long-range planning for civil aviation entails the detailed study of all components of aviation systems in order to forecast requirements on an integrated basis for the future.

Specifically, the philosophy of aviation systems planning insofar as the planning of airports is concerned involves forecasting traffic growth, recommending airport layout concepts for ultimate site development and, within this layout, planning systems concepts to accommodate needs for the next twenty-year period. The objective is to determine the staged development of each airport to keep all the systems in balance and to provide a phased construction programme to meet the planned requirements.

The aviation systems that are studied and then integrated into a completely balanced concept are: runway and taxiway configuration and terminal airspace; passenger terminal area; air cargo area; general aviation area; airport operations and maintenance area; commercial areas; and ground access.

The Department of Transport has established an office of Aviation Systems Planning within the Civil Aviation Branch. The responsibility of the office is to make certain that the systems approach is taken to aviation planning, which includes a multi-discipline approach in establishing airport concepts. The disciplines normally considered to be the minimum necessary to prepare an effective airport plan for mainline airports are as follows: aviation planner; applied operational research analyst; architect; civil engineer; economist; aircraft performance engineer; transportation specialist; and statistical analyst.

A Master Plan Report is prepared for each airport, from which a Master Plan for the future, showing staged construction of facilities, is prepared. This report may be prepared either by consultant firms retained by the Department or by departmental staffs.

The planning of airports cannot be undertaken without close integration of planning with other agencies.

Special measures have been taken to effect this liaison, as illustrated in Figure 1.

AIRPORT PLANNING PHASES

The airport planning process is divided into four phases:

Phase I	-	Forecasts
Phase II	-	Airport Layout Concept
Phase III	-	Airport Systems Concepts
Phase IV	-	Aviation Systems Analysis

PHASES I, II and III:

The work outline for the first three phases is described in the document "Scope of Work to Develop a Master Plan Report for Mainline Airports", at Appendix A.

These three phases include the development of long-range forecasts, the determination of an ultimate airport layout that will best utilize the existing site and provide a framework within which future expansion can take place and the development of those facilities that will be required in the coming twenty year period.

PHASE IV:

An Aviation Systems Analysis Group measures each aviation system on airports during the peak period, on a scheduled basis. This information is then analyzed and the forecast adjusted. The objective is to adjust forecasts against actual growth and to change the stages of construction accordingly if necessary. The Systems Analysis Study is one of the basic documents used in the planning of airports and adjusting the long-range plans that have been established.

The aviation systems planning approach to airport planning may be applied to any type of airport from the smallest to the largest. These procedures are designed for Canadian conditions and circumstances.

Planning authorities in other countries may find that, with some changes to suit their particular circumstances, this planning method would be equally effective when related to their particular planning problems.

AVIATION SYSTEMS PLANNING SHOWING
HOW INTEGRATION IS EFFECTED

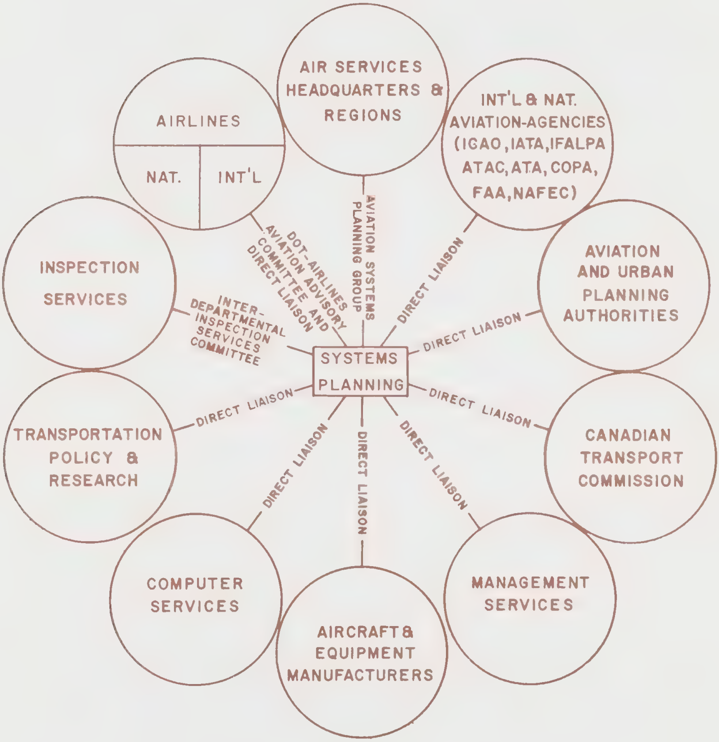

FIGURE 1

SCOPE OF WORK TO DEVELOP A MASTER PLAN REPORT FOR MAINLINE AIRPORTS

PLANNING, RESEARCH & DEVELOPMENT,
CIVIL AVIATION BRANCH,
DEPARTMENT OF TRANSPORT

APRIL 1, 1967

Revised
12/7/67

FOREWORD

The Department of Transport is currently developing Master Plan Reports for major Canadian airports as part of a long-range aviation systems planning programme. This programme is essential for future development of these airports. The recommendations will then be considered by Department management for inclusion in the Master Plan to facilitate economic and timely development of the site.

The scope of work to be undertaken is described herein. In brief, it will involve forecasting traffic growth, recommending airport layout concepts for ultimate site development, and within this layout, to plan systems concepts to accommodate user needs for the next twenty-year period.

In order to ensure a full and comprehensive study, the Department intends to use a multi-discipline approach with the following disciplines a necessary minimum:

1. Aviation Planner
2. Applied Operational Research Analyst
3. Architect
4. Civil Engineer
5. Economist
6. Transportation Engineer
7. Statistical Analyst
8. Aircraft Performance Engineer

INDEX

WORK OUTLINE

PHASE I - FORECASTS

Develop long-range forecasts covering aviation operations, economic and other factors on which future planning can be based;

PHASE II - AIRPORT LAYOUT CONCEPTS

Determine an ultimate airport layout that will best utilize the existing site and provide a framework within which future expansion can take place;

PHASE III - AIRPORT SYSTEMS CONCEPTS

Development Airport Systems Concepts and identify development that will be required during the coming twenty-year period to meet forecast requirements of airport users.

SCOPE OF WORK

PHASE I - FORECASTS

Taking into consideration technical, economic, geographic, climatic, social and industrial factors and their probable effect on air commerce in the area under study, develop long-range forecasts which will include but not be limited to the following factors:

(a) ECONOMIC

(1) Suitability of site location to meet present and anticipated future requirements of populated area served.

(2) Economic status of area served and future potential.

(3) History and 20-year forecast of passenger and cargo (freight, mail and express) movements by origin/destination, enplaned/deplaned for scheduled and non-scheduled operations.

(4) Present and anticipated future competitive position of air transportation with respect to other transportation modes.

(5) Future land requirements and activity of major airport tenants such as the Department of National Defence, air carriers, fixed-base operators and other government agencies.

(b) OPERATIONAL

(1) Present and potential status of site with respect to domestic, transborder and international airline route structures.

(2) Present and anticipated future aircraft mix for air carriers and general aviation.

(3) Present and potential general aviation activity.

(4) History and 20-year forecast of aircraft movements by aircraft mix, class of operation and runway utilization.

(5) Inspection services statistics and 20-year forecast.

(6) Aircraft gate utilization statistics for scheduled, non-scheduled and charter aircraft and 20-year forecast of requirements.

(7) Vehicle mix, traffic flow, public, employee and other parking statistics and 20-year forecast of requirements.

(b) OPERATIONAL

(8) Aircraft refuelling statistics and 20-year forecast of requirements to serve both air carrier and general aviation aircraft.

(9) The effect on airport concepts of new or existing airports in the vicinity.

(c) FINANCIAL

(1) Capital investment, depreciated value and current value of Department of Transport and other fixed installations at airport.

(2) Value of other assets such as registered zoning, easements, off-airport access roads and utilities.

(3) Current value of land including history and forecast of annual percentage increase in land values for area.

(4) History and forecast of tax rates (or grants in lieu) for airport property.

(5) Prepare cost benefit comparisons to illustrate advantages or disadvantages of advance land acquisition for future airport development.

PHASE II - AIRPORT LAYOUT CONCEPTS

Utilizing the forecasts developed in PHASE I, prepare a framework within which future expansion of the site can take place so that it can be developed to its ultimate capacity.

The economics of the site are of great importance. Careful consideration must be given to whether or not the costs of development of the site beyond a certain capacity will exceed the benefits to be derived. Not all sites are ideal and not all can be developed to an equal ultimate capacity because of economic constraints. The challenge then is to plan each site to its individual ultimate capacity without allowing the cost of such development to exceed the benefits.

There exist no universal yardsticks to relate the size of specific development areas to volumes of passenger, cargo and aircraft activity. There are also no perfect systems which all airport authorities use in determining the location of passenger, cargo and parking concepts in relation to each other to provide the most efficient service. Creativity in the proposed layout is therefore desirable but with the inclusion, where possible, of the best functional aspects of existing or planned airports. It is also necessary to ensure that operations will not be unduly restricted by noise constraints; that the airport layout has the desired flexibility for development beyond a 20-year period to ultimate use of the site; and that the existing facilities either in present or expanded form are utilized to their full potential in preference to entirely new construction.

General aviation activity at a major airport site can materially affect layout concepts and requires careful consideration and analysis. This heading covers a wide range of aircraft from the small trainer to the corporate jet. A field survey of general aviation operators shall be made to ascertain their future plans and requirements at this site or whether they intend or would prefer to move to a satellite airport. The present and future capacity of runway configurations to support the activity must be considered. In the event that capacities will be overtaxed, suitable alternatives must be devised. Part or all of this activity may best be moved to satellite airports or special runway configurations may be developed at the major airport site. Costs, type of operations, availability of satellite or potential satellite sites and operators' preferences must all be considered.

The concepts shall be based upon forecasts developed in PHASE I and studies of the existing site and environs which will include but not be limited to the following considerations.

(a) <u>OPERATIONS STUDIES</u>

(1) Terminal airspace
(2) Runway capacity under IFR and VFR weather conditions
(3) Airport systems capacity and utilization
(4) Obstruction zoning and navigational aid restrictions
(5) Noise (sensitive areas and profiles)
(6) Meteorological conditions and wind rose
(7) Other adjacent airports
(8) General aviation

(b) <u>PHYSICAL STUDIES</u>

(1) Availability of adjoining land suitable for expansion
(2) Topographical and cultural restraints that would limit further expansion
(3) Availability of land for use as an alternate or satellite airport
(4) Access and public road systems
(5) Utilities

The airport layout concepts which are to be included in PHASE II proposals must include the following:

(a) Airport runway, taxiway and apron configuration
(b) Passenger Terminal location
(c) Air cargo location
(d) General aviation location
(e) Airport operations and maintenance location (s)
(f) Commercial locations
(g) Access road/highway connections
(h) Parking locations

Alternate concepts are to be provided in instances where there is more than one practical choice. A brief summary shall be provided of any other concepts which were studied and rejected and the reasons for their rejection, in order to provide an indication of the depth of the study.

PHASE III – AIRPORT SYSTEMS CONCEPTS

Utilizing the FORECASTS developed in PHASE I and based on the optimum AIRPORT LAYOUT developed in PHASE II, prepare development concepts for the following airport systems:

(a) Passenger Terminal Area
(b) Air Cargo Area
(c) General Aviation Area
(d) Airport Operations and Maintenance Areas
(e) Commercial Areas
(f) Road System

FACTORS TO BE TAKEN INTO CONSIDERATION IN THE DEVELOPMENT OF CONCEPTS FOR EACH SYSTEM ARE AS FOLLOWS:

CONCEPTS FOR THE PASSENGER TERMINAL AREA

Before listing the components of a terminal area and the functions expected from each component, it is advisable here to stress that the concepts proposed for each component must meld themselves into an efficient master circulation system involving vehicles, people and aircraft. Terminal areas at airports throughout the world are based upon various systems, all of which have certain advantages and disadvantages. It is obvious, then, that no one perfect system has yet evolved to provide a master plan for others to copy in its entirety. In addition to the present diversity of opinion as to the best system for a terminal area to employ, there is the new problem of radically changing aircraft types which will soon be in service and must be provided for in any proposal for airport and terminal area development. The Department is not opposed to the proposing of a new and untried system or new and untried parts of a system.

To substantiate these new proposals, reasoning must be provided to show why they are operationally and/or economically advantageous.

The Department will require alternate concept proposals wherever alternatives are considered to be of logical and practical value.

TERMINAL BUILDING

(a) Location - If practicable the building shall be located between primary runways and orientated to facilitate efficient aircraft and vehicle traffic flows. Since it is the activity hub of the airport, its location shall be considered in conjunction with the related areas assigned to cargo, express, post office, parking, maintenance bases, flight kitchens, ramp equipment building and servicing facilities and any other services which require ease of access by either road or taxiway to the terminal area. It shall be reasonably close to highway systems, present and planned, which can accommodate access road junctions and airport generated traffic without undue congestion.

(b) Concept - The building concept shall be such as to permit the efficient flow of people, baggage and vehicles at the forecast levels of activity. Space standards for the basic components of the building developed and used by the Department and agencies of government in other countries are not necessarily reliable for future building concepts. Past experience has shown that site characteristics such as proximity to heavily populated areas and availability of public transport to the airport have a direct bearing on activity volume and create variables in space requirements from site to site. Therefore, after due consideration of existing standards, it may be found desirable to develop, justify and use entirely new space standards applicable to this site. The building shall be capable of incremental expansion in planned stages to accommodate user requirements over the 20-year study period and such further expansion as might reasonably be required at the ultimate development level of the site if this is forecast to occur beyond the 20-year study period.

Building concepts provided are to include provisions for:

Departing and arriving passengers.
In-transit passengers.
Inspection and pre-clearance services where required.
Passenger protection from weather, noise and fumes.
Visitor accommodation, observation areas and separation from passengers where required.
Passenger services such as restaurant and bar facilities, washrooms, lockers, concessions, car rental agencies.
Baggage handling including mechanical aids with flexibility for adaption to advanced systems of direct aircraft to claim facility transfer.
Ease of passenger movement both vertical and horizontal with consideration to shortness and directness of movement, convenience and capacity of aids such as escalators, moving sidewalks and elevators.
Airline accommodation, offices, ticket counters, dispatch facilities, crew rooms and ramp services.
VIP rooms and services.
Department accommodation, offices, building maintenance, trade shops, air traffic control, communication and meteorological facilities.
Heating, air conditioning and utility systems.
Delivery and docking facilities.

Storage areas for tenants, concessionaires and maintenance requirements.

Adequate usable curb space for loading and unloading of passengers with provision for baggage reception facilities if this concept is recommended with airline endorsement.

Sign or area identification system to expedite passenger flow and avoid confusion.

Any other activity which is recommended for incorporation in the proposed concept such as car park, rapid transit terminal, passenger or baggage conveyance systems, aircraft loading or servicing facilities.

Any novel techniques or systems considered superior to present methods of operation which are proposed for inclusion in the concept.

ROADS

(a) Access - These roads shall provide access between the terminal and selected highway system or systems with provision for planned expansion and separation of inbound, outbound, automobile, truck, airline passenger and visitor vehicles to accommodate forecast peak-hour vehicle traffic covering the 20-year study period.

(b) Service - These roads, within the confines of the airport area, shall permit ease of access to and from the terminal building and other development areas without interfering with the free flow of traffic on the access roads. They shall logically terminate at the terminal complex and also have direct access to terminal building docking areas in order that the terminal building may be efficiently serviced in both its original and expanded forms. There must be interconnection between service and access road systems to serve the appropriate development areas.

TERMINAL RAMP

(a) Gates - The gate positions for loading and unloading of aircraft shall meet the user demands at forecast levels of activity throughout the 20-year study period under a projected phased expansion programme complementary to the terminal expansion programme and shall be capable of further expansion to ultimate site development if this is forecast to occur beyond the 20-year study period. The gate positions may be of varying size but shall be capable of handling all types of aircraft which can reasonably be forecast to use the airport in the foreseeable future and shall be consistent with the method of loading and unloading of passengers and baggage which is proposed for use in the terminal building concept.

(b) Maintenance Space - There is a requirement for short-term aircraft parking convenient to the gate positions. This area is to be investigated in conjunction with the air carriers to provide a relationship between short-term parking space requirements and gate positions in order that provision shall be made for this type of space to be expanded in conjunction with the gate and terminal phased expansion programme.

(c) Refueling - A detailed study and inventory of present refueling capacity, the method in use and airline requirements and recommendations shall be made to form the basis of a proposed refueling system. This shall include the type of system, the storage facilities and location, and if an underground system is recommended, the connecting distribution lines in capacity, number and location, the number and location of pits or hydrants and the method and facilities for delivery at each end of the system. The expansion of this system shall also be programmed in conjunction with the gate and terminal building phased expansion to meet the needs of all aircraft which can reasonably be forecast to use the airport in the 20-year period.

(d) Aircraft Servicing - Since aircraft servicing is an operating company responsibility, it is necessary to develop expansion of, and improvement to, the system in close liaison with these companies. The housing and maintenance of servicing equipment must be considered and provision made for phased expansion of these facilities for the 20-year period. Flexibility of the system to meet the needs of forecast aircraft types and the capability to expand with the site beyond the 20-year period is essential.

PARKING

(a) Public - The public car parking facilities, whether proposed for incorporation as an integral part of the terminal building, or as a separate facility, shall meet the user demands at forecast levels of activity throughout the 20-year study period and shall aesthetically meet the standards of the terminal complex. The location and type of facility shall be planned to take into consideration the modern objective of a short and efficient passenger transfer from automobile to aircraft and from aircraft to automobile. Separation of airline passenger automobiles from sightseer automobile congestion is advisable if practical. Short-term public metered parking areas shall be provided if this is considered advantageous to the overall parking concept recommended.

(b) Commercial Vehicles - Separate and adequate parking is to be provided for car rental, taxi, passenger limousines and buses within reasonable call-up distance from the curb loading area.

(c) Staff - Staff parking requirements shall be projected over the study period and space allotted with expansion potential to coincide with the phased expansion programme of the terminal and related facilities.

OTHER FACILITIES

Provide opinions, recommendations and examples of the advisability of locating other facilities in the terminal area concept separate from the terminal building, such as hotel/motel, automobile service station, drive-in bank and office buildings with locations and road systems if recommended.

CONCEPTS FOR THE AIR CARGO AREA

It is probable, as lift capacity increases, that a reduction may occur in the relative volume of cargo carried at present on a space available basis which now requires storage at originating or en route airports until space becomes available. The possible decline in the ratio of required warehouse storage to total tonnage carried shall be considered. Present and firmly planned cargo facilities shall be examined and appraised for adequacy of continued use or incorporation into a proposed new system. The cargo concepts proposed shall be based upon the forecast of volume, handling techniques and the evolution of the industry determined in PHASE I. The required land area only is to be indicated.

(a) Location - The location, as determined in PHASE II, shall be planned to meet existing needs and capable of expansion according to forecast requirements over the 20-year study period and to eventually meet the demands of ultimate site development.

CONCEPTS FOR THE GENERAL AVIATION AREA

The development of this area will be directly affected by the forecasts, the results of the operator survey and the recommendations regarding general aviation activity contained in PHASES I and II. The effectiveness of the present Departmental hangar land leasing policy shall be investigated and a determination made as to its adequacy. It may be more advantageous to consider renting hangar land as a packaged unit, including the land used for outside aircraft parking, aircraft servicing and employee parking, along with the actual hangar area, based on a formula related to hangar floor size.

(a) Location and Development - Taking into consideration the survey of general aviation users, the airport layout concepts in PHASE II, the policy recommendations and the proposals and conclusions in regard to encouraging limited or unlimited growth, provide phased expansion plans covering acreage, road system, hangar area requirements, tie-down areas, maintenance and repair requirements, Customs and Immigration requirements, flight planning and Meteorological briefing facilities, employee and customer automobile parking, and any other services and facilities which general aviation requires or is forecast to require during the 20-year study period, with provision for ultimate site development.

CONCEPTS FOR THE AIRPORT OPERATIONS AND MAINTENANCE AREAS

These areas shall include the Airport Equipment Garage, Fire Hall, Sand Storage Building, Power Plant, Emergency Power Plant, Central Heating Plant, Airport Maintenance Equipment Outside Storage Area, Snow Disposal Area, Crash Fire Training Area, General Storage and the Operations Building for Meteorology, Air Traffic Control and Aeradio. The fire hall location shall be examined in relation to new runway configurations to determine optimum accessibility from a crash-rescue standpoint. The present operational facilities shall be evaluated, and their adequacy in regard to design life, their provision for expansion and their location and capacity in relation to the proposed concepts of areas which they serve determined.

(a) Location and Development - Taking into consideration the evaluation of present facilities and the airport layout concepts in PHASE II, a phased expansion programme covering acreage, road system, integration of present facilities, plant capacities, automobile and equipment parking, storage and maintenance to cover the 20-year study period, with provision for ultimate site development shall be provided.

CONCEPTS FOR THE COMMERCIAL AREAS

This shall include the use of development areas not required for essential aviation services located in areas previously covered. It shall include recommendations in regard to policy for use of such areas and the extent to which development of airport property should be encouraged and types of enterprise or new activities for which it should be made available. A survey shall be conducted of present businesses, including requirement for location on the airport and advantages or disadvantages to the airport operation. Some examples of enterprises presently located on airports are: U-Drive Servicing, aircraft sales, aviation repair shops, aerial survey companies, airport hotels/motels, gasoline stations, office building, radio sales and servicing, golf courses and driving ranges and some limited use by other government or crown-supported agencies such as the National Research Council.

(a) Location and Development - Taking into consideration the present commercial activities on the airport, the airport layout concepts in PHASE II and the policy recommendations proposed, provide recommendations for the development of these areas to cover the 20-year study period, with provision for ultimate site development.

ROAD SYSTEM

The access and service roads serving each particular development area shall be planned to form an integral part of a road system which shall include the best use of present and planned highway systems, the proposed access and on-airport service roads and their necessary inter-connections. This master system shall be phased to efficiently accommodate the forecast vehicular traffic throughout the 20-year period and be further capable of expansion for ultimate site development.

MASTER PLAN REPORT FORMAT

A report is required at the conclusion of PHASE II which shall contain but not be limited to the following:

(1) 20 copies of a report containing the information on each proposed concept as follows:

(a) An airport Master Layout Concept showing runways, aprons, taxiways, major buildings, road systems, parking areas, boundary limits and location of development areas.

(b) Substantiating graphs and mathematical forecasts and other pertinent information developed in PHASE I.

(c) Diagrams illustrating the movement, loading and unloading systems of people, vehicles and aircraft on which the layout is based.

(d) Word description.

(e) Cost/benefit analysis in terms of 1967 dollars.

(f) Economic evaluation.

(g) Operational efficiency comparisons.

(h) Recommendations and opinions

A report is required at the conclusion of PHASE III which shall contain but not be limited to the following:

(1) One schematic three-dimensional model to show the total planning effort, contrastingly coloured to illustrate the phased expansion proposed over the 20-year study period to accommodate forecast requirements. The colour coding shall relate to the year of completion of each facility or addition to an existing facility and shall not be concerned with lead times.

(2) Fifty copies and one reproducible copy of the final master plan report containing but not limited to the following:

(a) All information including graphs and forecasts contained in the PHASE II report relevant to the final report.

(b) A phase by phase description including capital costs and capacity of the site redevelopment programme covering the 20-year study period, with colour coding to relate to the model.

(c) Schematic plans and sections of terminal facilities to explain size and relationship of all elements, character and general configuration of facilities which will also show passenger circulation, baggage circulation , ground vehicle circulation, loading and unloading, aircraft servicing vehicle circulation, loading and unloading, and the overall flexibility for phased expansion.

(d) Schematic plans and sections of ramp and terminal building to explain the aircraft loading, unloading and servicing systems and the compatibility of the systems to aircraft types and loads and flexibility for phased expansion.

(e) Sketch, plan and written descriptions of any novel elements of the circulating or loading systems requiring more detailed explanation.

(f) Diagrams of road and parking systems throughout their expansion phases.

(g) Diagrams, functional plans and descriptions of air cargo, general aviation, airport operations and maintenance and commercial areas throughout their expansion phases.

(h) An equivalent presentation of alternative proposals for all or any part of the system where alternatives have meritorious and practical value, together with economic and operational efficiency comparisons.

(3) Not more than four formal oral presentations with graphic charts and plans suitable for group briefing.

SPECIFICATION REFERENCES

1.0 ICAO PUBLICATIONS

.1 Annex 3, Chapter 2
.2 Annex 10
.3 Annex 14
.4 Aerodromes Manual
.5 ICAO Journal (June 1966)

2.0 IATA PUBLICATIONS

.1 Airport Buildings and Aprons (3rd Edition)
.2 Airport Terminals (4th Edition)

3.0 DEPARTMENT OF TRANSPORT PUBLICATIONS

.1 Air Services Objectives and Policies
.2 Metereological Branch - Instrument Detail Issue Sheets (MIDIS) and Scale of Issue Manual (METSCAL)

4.0 FEDERAL AVIATION AGENCY (U.S.A.) PUBLICATIONS

.1 Terminal Air Traffic Control, AT 7110-8
.2 En Route Air Traffic Control, AT 7110-9
.3 Advisory Circulars
.4 Technical Report, System Description - Weather Teletypewriter Communications System RD-66-21
.5 "Aviation Demand and Airport Facility Requirement Forecasts for Large Air Transportation Hubs through 1980" - August 1967

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1. "Voyageurs of the Air" - a History of Civil Aviation in Canada 1858 - 1967 - by J.R.K. Main, Published 1967.

2. "Civil Aviation in 1967" - ICAO Bulletin, May-June 1968, Vol. XXIII, Nos 5-6.

3. "Civil Aviation in Canada" - ICAO Bulletin, March 1968, Vol. XXIII, No. 3.

4. "Summary of Operations of the Department of Transport and of other Boards, Commissions, and Agencies which report to Parliament through the Minister of Transport". Prepared by Information Services, Department of Transport - January 1, 1968.

5. "Systems Planning in Air Services, Department of Transport" by D.R. Hemming, Chief, Aviation Planning and Research - presented at the Canadian Transportation Research Forum, Vancouver, May 1968.

6. Address by Knut Hammarskjold, Director-General of IATA, to the "Airports for the Future" Conference - London, April 1967.

7. "Future Air Traffic and Implications for Airports" by Roderick Heitmeyer, Chief Economist, IATA, - Presented at the 17th Technical Conference of IATA, Lucerne, October 1967.

8. "The Year 2000 - A Framework for Speculation on the next Thirty-Three Years" by Herman Kahn and Anthony J. Weiner - Hudson Institute - Published 1967.

9. "Airport Capacity Criteria Used in Preparing the National Airport Plan" - prepared by the Federal Aviation Agency, August 1966, A/C 150/5060.

10. "Planning and Design of Airports" - Professor R. Horonjeff, University of California, Berkely, 1962.

11. "Geometrical Standards for Runways, Taxiways and Aprons" - Department of Transport, January 1966.

12. "Aviation Demand and Airport Facility Requirement Forecasts for Large Air Transportation Hubs through 1980" - FAA, August 1967.

13. "Canada's Role in the Second Decade of the Space Age - Inner Space Supersonics"- by J.T. Dyment, Senior Engineer, Air Canada. Presented to the 1967 Congress of Canadian Engineers (SAE), Montreal, May - June 1967.

14. "Beyond the Supersonic Transport" by William H. Avery - Science & Technology - February 1968.

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15. "The SST - Economic Tightrope for the Airlines", by I.S. Macdonald, Air Canada - Presented at the 10th Anglo-American Aeronautical Conference, Los Angeles, October 1967.

16. "Symposium on Supersonic Air Transport", IATA - Prepared for the 14th Technical Conference, Montreal, April 1961 - Volume 1.

17. "Fuelling the Second Generation", by A.D. Radbone, Shell International Petroleum Company - 1967.

18. "Engineering the World's Airport Passenger Terminals - Prepared for the Symposium of the Institute of Civil Engineers, London, London 1966.

19. "Technological Progress and the Airlines", by Dr. R.R. Shaw, Technical Director, IATA, Presented to the Royal Aeronautical Society and the Cranfield Society, Cranfield, June 1967.

20. "Airports for the Future" - Institution of Civil Engineers, London, April 1967.

21. "Prospects in Aeronautics Research and Development, by Charles W. Harper - Presented at the AIAA Aircraft Design for 1980 Operations Meeting, Washington, February 1968.

22. Statistics from Aerospace Technology, May 1968.

23. "STOL Aircraft - a Perspective" by R.D. Hiscocks - Flight International, October 1967.

24. "An Abstract from a Study of Air Travel Forecasting Techniques", prepared by Kates, Peat, Marwick & Co. for the Department of Transport, April 1967.

25. "Airports in Canada", by D.A. Lane - Presented to the U.P.A.D.I. 9th Congress, Mexico City, October 1966.

26. "Canada in the Jet Age" - Prepared by the Department of Transport Air Services Division, November 1962.

27. "All- Weather Landing and Take-Off" - Prepared for the 15th Technical Conference, Lucerne, April - May 1963, Part 1.

28. "Facility Planning" - prepared by the Boeing Company, Renton, September 1967.

29. "Boeing Jet Transport Planning" - Prepared by the Boeing Company - latest revision.

30. "Boeing 747 - General Description" - Prepared by the Boeing Company.

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31. "Future U.S. Transportation Needs", by A.H. Norling, United Research Incorporated, Cambridge, Distributed by Clearinghouse for Federal Scientific and Technical Information, 1963. No. N 64 25006

32. "Procedure for Describing Aircraft Noise Around an Airport", International Organization for Standardization, October 1966.

33. "Major Airport and Terminal Area Problems" - Prepared by IATA for the 17th Technical Conference, Lucerne, October 1967. Volume 1 - Summary of Proceedings.

34. "Major Airport and Terminal Area Problems" - Prepared by IATA for the 17th Technical Conference, Lucerne, October 1967. Volume II - Selected Working Papers.

35. ICAO Report on the Fifth Air Navigation Conference, Montreal, November 1967.

36. "Air Services Objectives and Policies" - Prepared by the Department of Transport, latest revision.

37. "Aviation Systems Planning as Applied to the Development of an Airport", by C.E.B. McConachie - Presented at the Canadian Transportation Research Forum, Vancouver, May 1968.

38. "The Aviation Systems Approach to the Development of an Air Terminal Concept", by A.H.G. Mittermaier and P.H. Beinhaker - Prepared for the Fourth Annual Meeting of the Canadian Transportation Research Forum, Vancouver, May 1968.

39. "1968 Aviation Directory of Canada" - Canadian Aviation - April 1968, Vol. 41. No.4.

40. "1968 Interavia ABC" - Interavia S.A., 1968.

EXCERPTS FROM AUDIO-VISUAL SUPPLEMENT

This Section contains excerpts from a 30 minute audio-visual taped-slide presentation entitled "Airports for Export from Canada" which was prepared as a Supplement to the Planning Guide.

Copies of this presentation have been produced in English, French, and Spanish and have been distributed to Trade and Commerce Offices abroad for use by Canadians seeking to extend the export of Canadian capabilities in the Airport market.

Further information can be obtained from the Special Projects Section, Electrical and Electronical Equipment Division, Department of Trade and Commerce, Ottawa.

EXCERPTS FROM AUDIO-VISUAL SUPPLEMENT

LIST OF GRAPHICS REPRODUCED TOGETHER WITH ACCOMPANYING SCRIPT

GRAPHIC	SCRIPT
20. Shrinking Map of Canada	"....By the 1950's Civil Aviation in Canada had become big business, stretching across 3000 miles from coast to coast, and travel times were being dramatically reduced...."
24. Air Routes Network	"....The present air transportation system in Canada looks like this: Serving the principal population centres are the two major airlines plus heavy traffic from transborder and overseas. And of course there are many smaller airlines within the country...."
59. 707/747 Comparison Outline 61. Comparison Outline of Concorde and Boeing SST	".... These problems have been accentuated by the introduction into airline service of the stretched DC-8's and by the imminent arrival of high capacity jet aircraft such as the Boeing 747's. These aircraft are expected to be in service by 1970 and to carry up to 500 passengers. By 1972 the supersonic transports are expected - flying at speeds of nearly 2000 mph and carrying 136 passengers. By 1976 there should be another SST which will carry 350 passengers...."
68. Introduction to Master Planning	"....Because the Department of Transport operates most of the nations airports, Canada is in a preferred position to develop a co-ordinated approach to planning its air transportation system. The Department of Transport and its consultants have developed an Aviation Systems Planning methodology to produce balanced 20 year Master Plan Reports and phased development programmes which will allow the new aviation technology to achieve its full potential...."
69. Aviation Systems Planning - Integration	"....Aviation Systems Planning involves the integration of all the agencies and organizations, the component parts and the operating elements that make up the total air transportation system. It entails the application of scientific methods to the planning of these systems on an integrated and balanced basis...."

EXCERPTS FROM AUDIO-VISUAL SUPPLEMENT

GRAPHIC	SCRIPT
70. Aviation Systems Planning Team	"....Aviation Systems Planning is carried out by multi-disciplined teams - professionals in daily consultation with the Department of Transport. These disciplines, which are considered to be the minimum, combine with other disciplines to form the most powerful analytical approach yet achieved for the solution of aviation planning problems. The teams use all the analytical research methods available today including computers...."
71. Air Transportation Systems: Air- Interface- Ground	"....These are the systems analysed to produce balanced twenty year Master Plan development programmes. For balanced airport planning each system must be analyzed to ensure that its capacity matches that of the others and that the capacity of all will satisfy the demand...."
73. A Canadian International Airport - Existing Facilities	"....Let us examine the application in part of these methods to a typical Canadian International Airport. The number of runways and their orientation may be considered to be the basic framework of the airport around and within which the passenger terminal complex, the air cargo, general aviation, maintenance, and other areas are to be developed. This is the runway configuration and location of the major facilities as they exist today...."
74. Passenger Volumes (millions)	"....The present and forecast passenger traffic for this airport is 2.5 million in 1965 rising to approximately 12 million by 1980...."
75. IFR Peak Hour Movements	"....Here we have present and forecast aircraft activity - air carrier peak hour movements - 22 in 1965 growing to 51 in 1980 and general aviation - 9 in 1965 growing to 28 in 1980...."
76. Combined IFR Peak Hour Movements	"....This is their combined IFR peak hour movements and since the peak movements do not occur at the same time of day, general aviation peak hour movements have been adjusted to provide the combined total...."

EXCERPTS FROM AUDIO-VISUAL SUPPLEMENT

GRAPHIC		SCRIPT
77.	Ultimate Runway Development	"....This framework of runways would be suitable for an international airport expecting a demand of over 100 aircraft movements per hour. There are triple parallel runways: two of these permitting simultaneous IFR operations while the third is available for general aviation and air taxi operations. This third runway could be extended to permit long haul air carrier operation at a later date...."
78.	IFR Capacity	"....The capacity values have been calculated for various combinations of runways. These ratings include the effects of such factors as weather, operational procedures, noise abatement requirements, ATC capabilities and an acceptable level of delay...."
79.	Present Passenger Facilities	"....On the present site, the passenger terminal area, air cargo, general aviation and maintenance areas are just about at capacity. With the arrival of the high-capacity jet aircraft a new dimension will have been added to the airports problem, especially in the apron manoeuvering area. With this new dimension in mind and using a decentralized linear module passenger terminal concept, which Canada is tending towards, the demands of the passenger terminal area to meet the forecast needs can be translated into acreage...."
81.	Future Passenger Terminal Facilities	"....A possible site for future passenger facilities is shown located between the runways. Besides providing for minimum taxi times, the site is one of the few places on the airport property which has a large uninterrupted area of land, available to meet the requirement. The first stage of runway development, a new 05L - 23R is also shown. Construction of this 11,000 ft. runway will be timed to conincide with the late 1970, early 1980 requirements. The second stage will be to develop a parallel to 14L-32R. The spacing of parallel runways has been determined by both the land requirement and the aircrafts operational requirements...."

EXCERPTS FROM AUDIO-VISUAL SUPPLEMENT

GRAPHIC		SCRIPT
82.	Future Air Cargo Area	"....This shows the future air cargo area, which allows expansion; access is provided to the runway system; in this position it may be possible to foster limited industrial development under the flightways of the two major runways; truck access to the terminal will be improved and many of the conflicts in the present operation will be removed...."
83.	Future General Aviation and Maintenance Areas	"....In the general aviation area there is both the area and the desire to expand in its present location. And while there are certain disadvantages in leaving the airline maintenance area where it is and enlarging the present site in the overall master design it's necessary to accept this compromise...."
84.	Probable Ultimate Development	"....The overall plan then shows the siting of all runways and ground facilities which it is believed will be needed to meet the demand in the 1985-1990 period. Tunnels under runways and taxiways will probably be required so as to give direct road access between facilities needing road services...."
87.	Centralized System	"....At major volume airports in Canada, the move is away from the traditional centralized planning concept, with its wasted floor area, extended passenger walking distances and resulting confusion, towards the decentralized linear modular concept. By providing efficient means for rapid processing of passengers; the area required is reduced; and by decentralization, walking distances can also be reduced. The application of modular concepts allows for economical and phased development...."
88.	Decentralized System	
89.	Decentralized Linear Module Concept	


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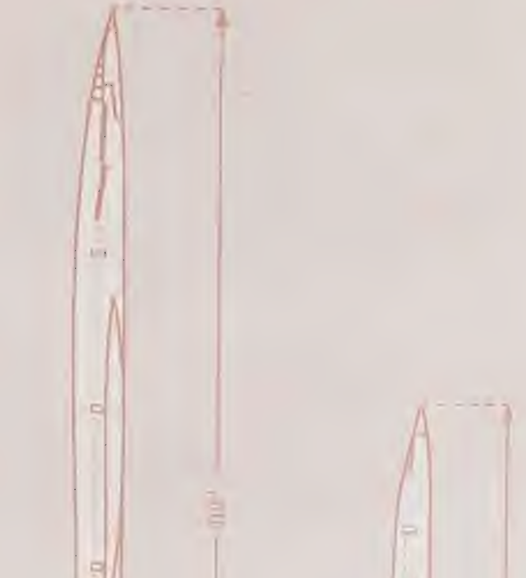

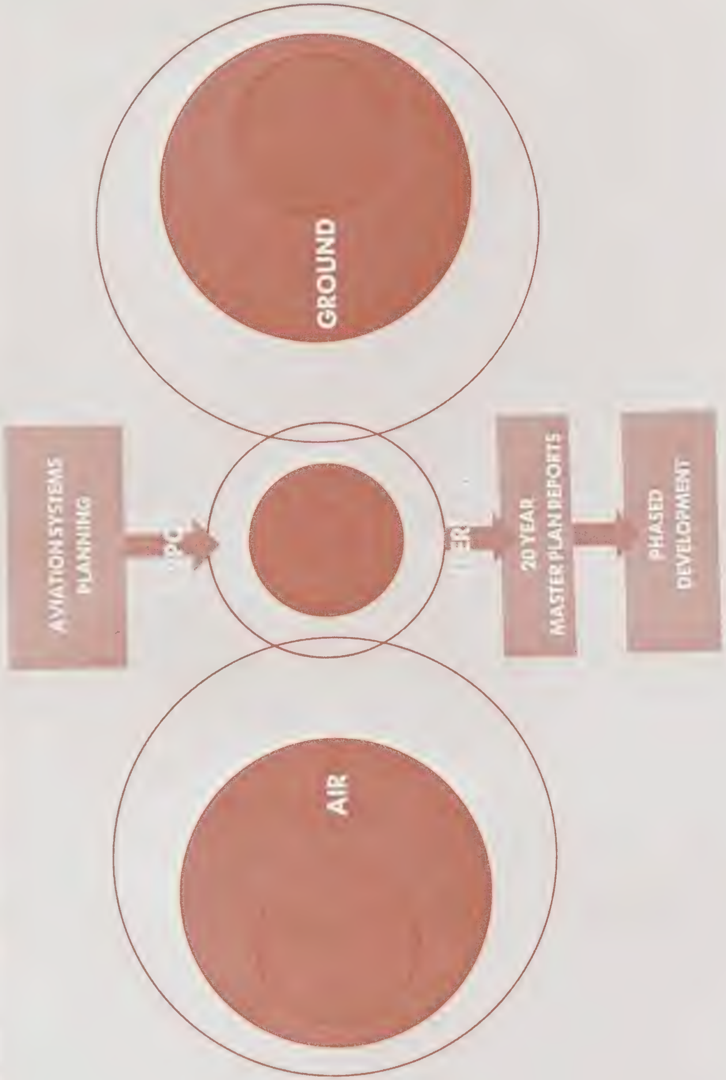
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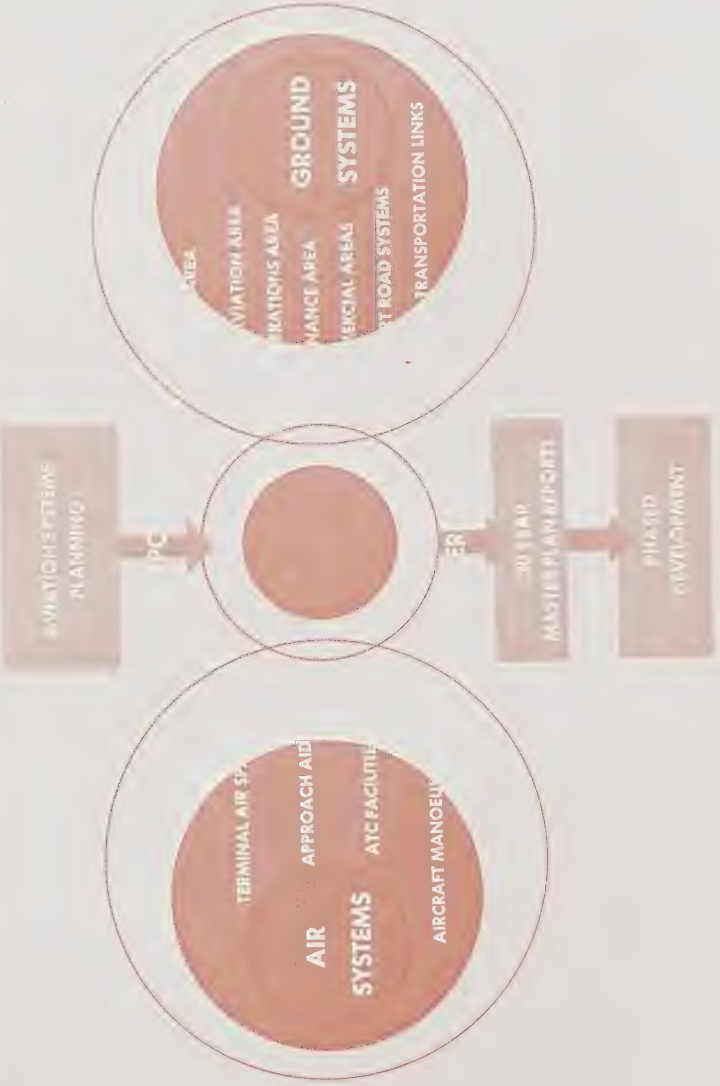
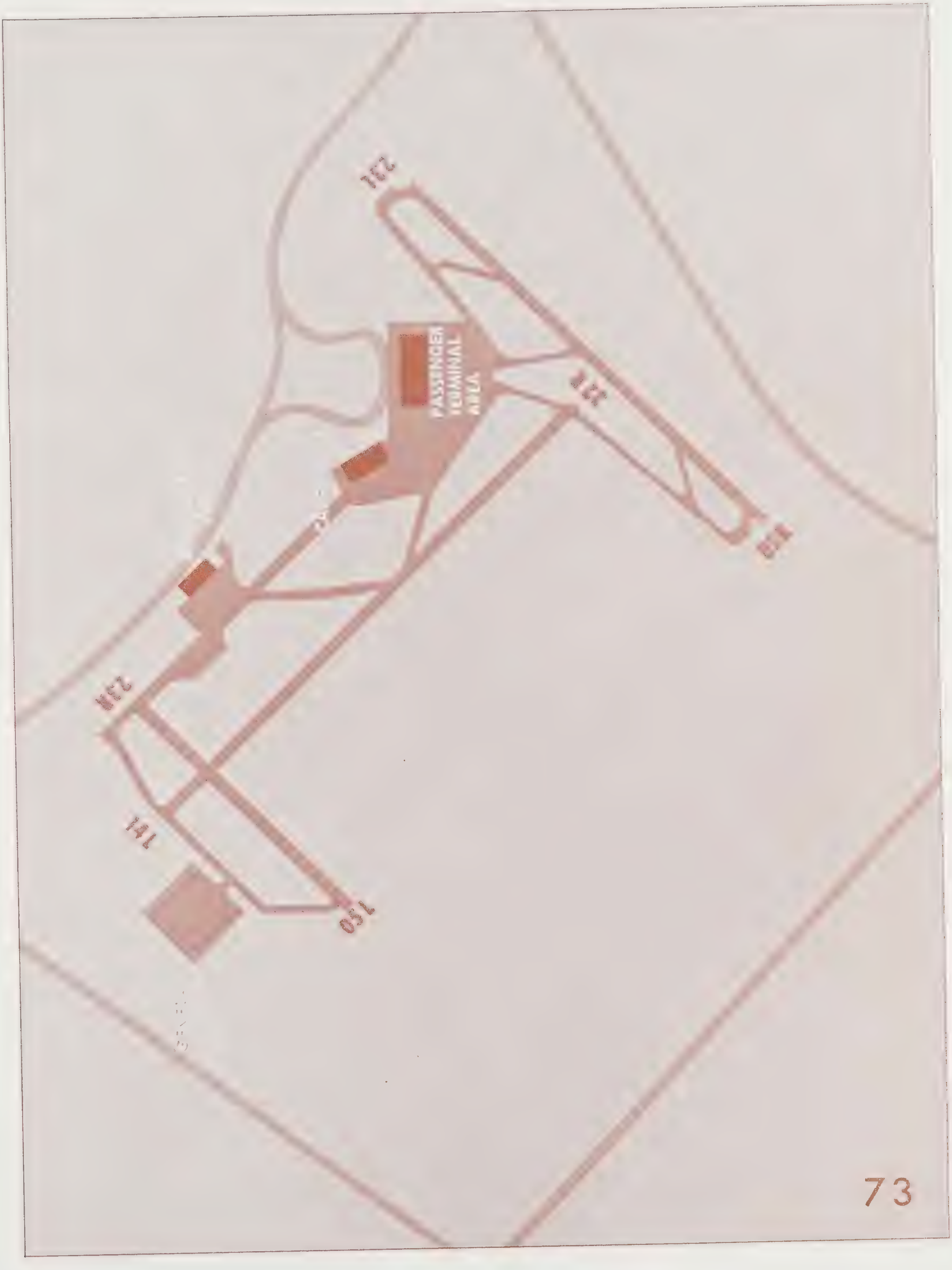
AVIATION SYSTEMS PLANNING
20 YEAR MASTER PLAN REPORTS
PHASED DEVELOPMENT
AIR


SYSTEMS PLANNING
ADVISORY COMMITTEE
INTERNATIONAL AND NATIONAL AVIATION AGENCIES
COMPUTER SYSTEMS
MANAGEMENT SERVICES
AIRCRAFT AND EQUIPMENT MANUFACTURERS
AVIATION SYSTEMS PLANNING
Integration

MULTI-DISCIPLINE SYSTEMS PLANNING TEAM



GROUND
SYSTEMS
TRANSPORTATION LINKS
AVIATION SYSTEMS
PLANNING
MASTER PLAN REPORTS
PHASED
DEVELOPMENT
AIR
SYSTEMS
TERMINAL AIR SPACE
APPROACH AID
AIRCRAFT MANOEUVRING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TERMINAL
AREA
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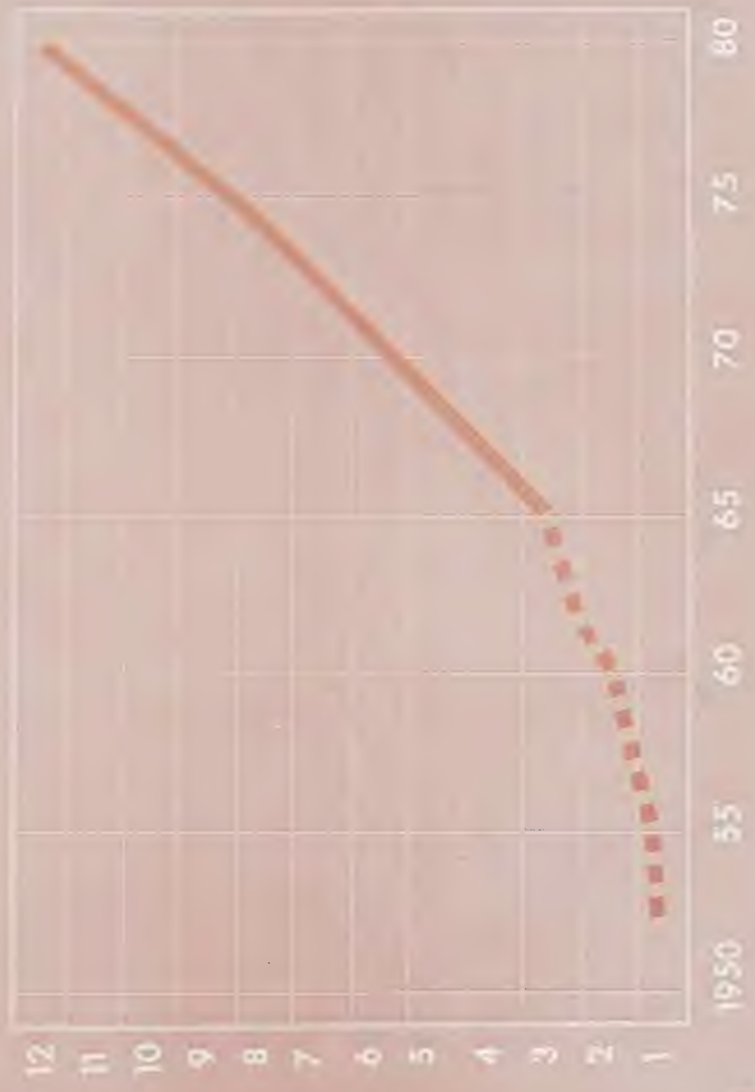
23R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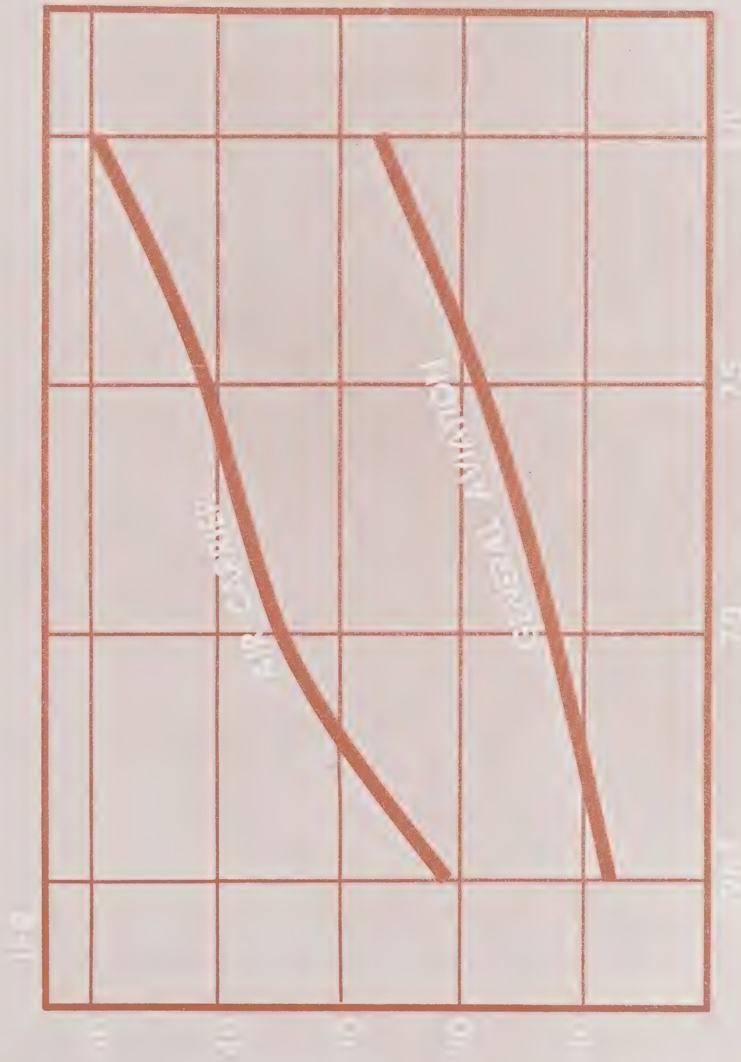
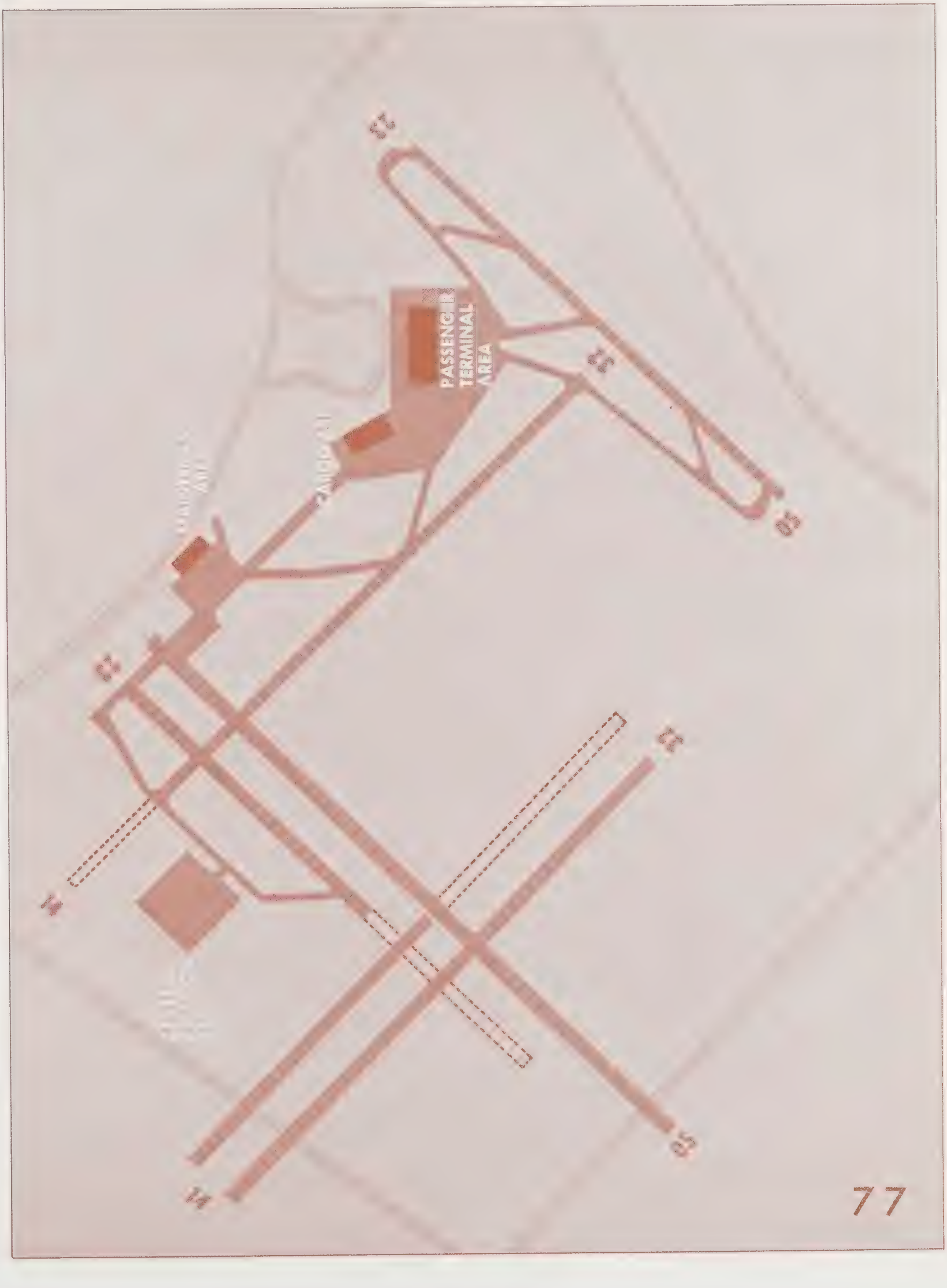
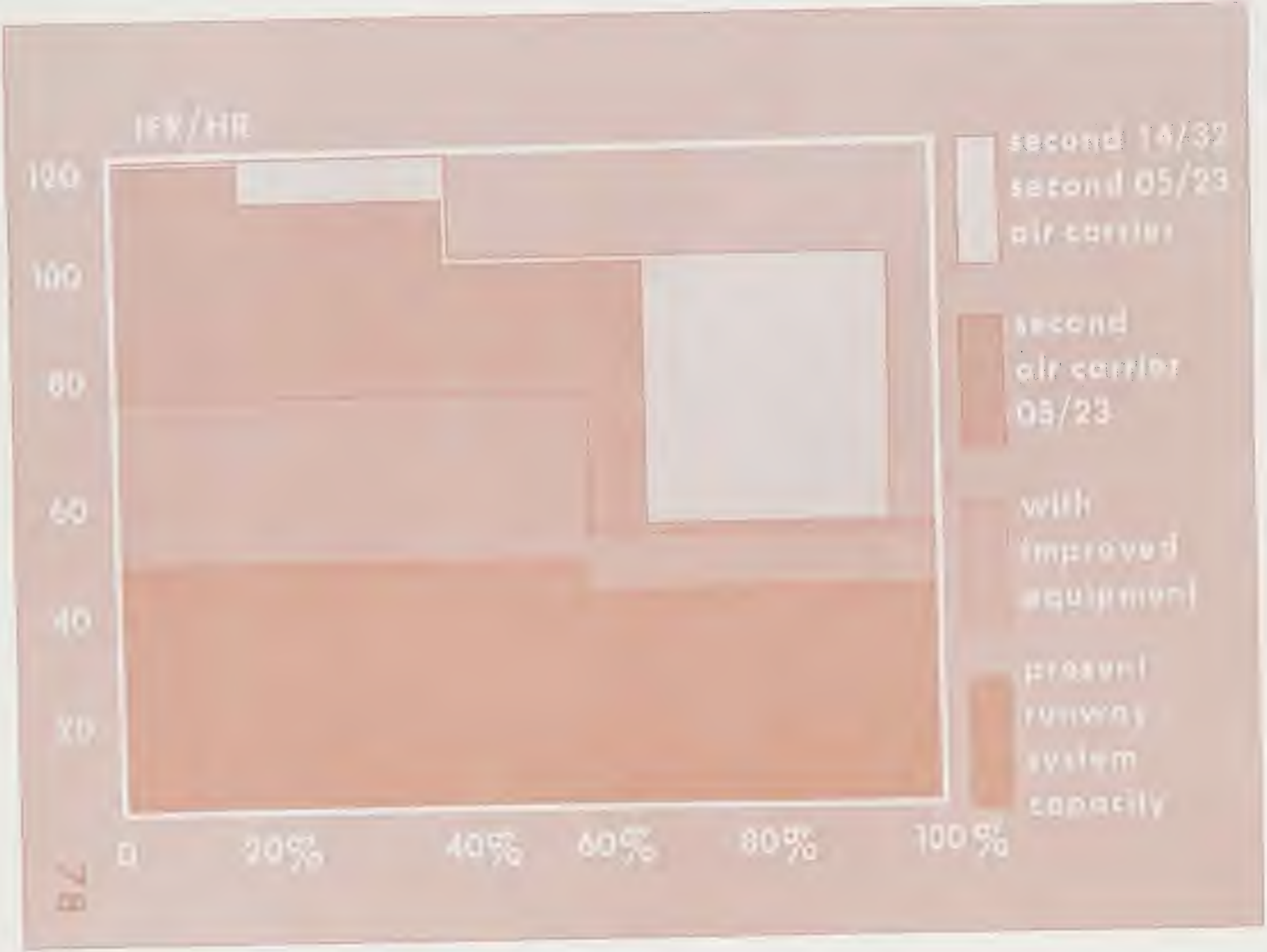
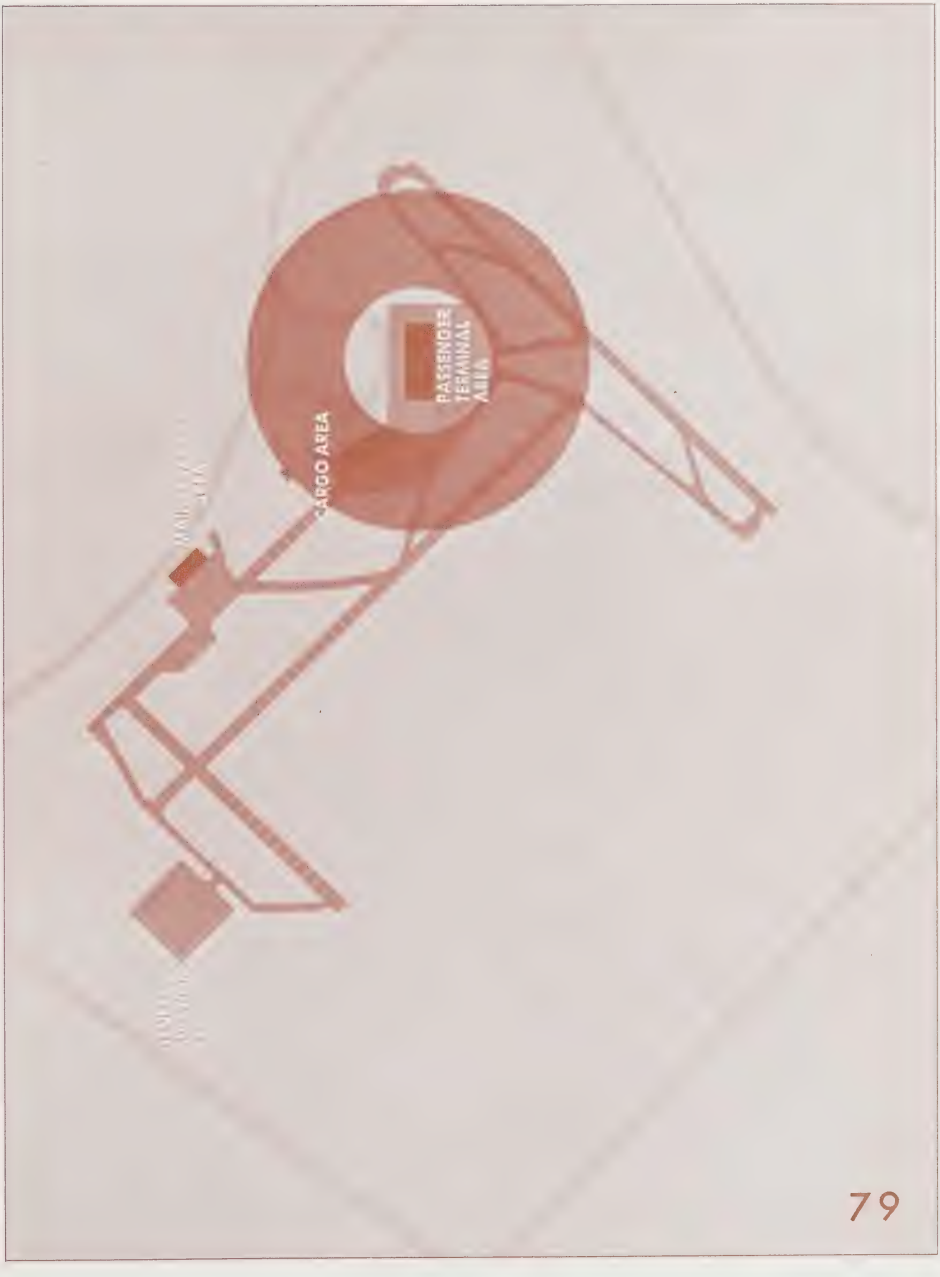

AIR CARRIER
GENERAL AVIATION

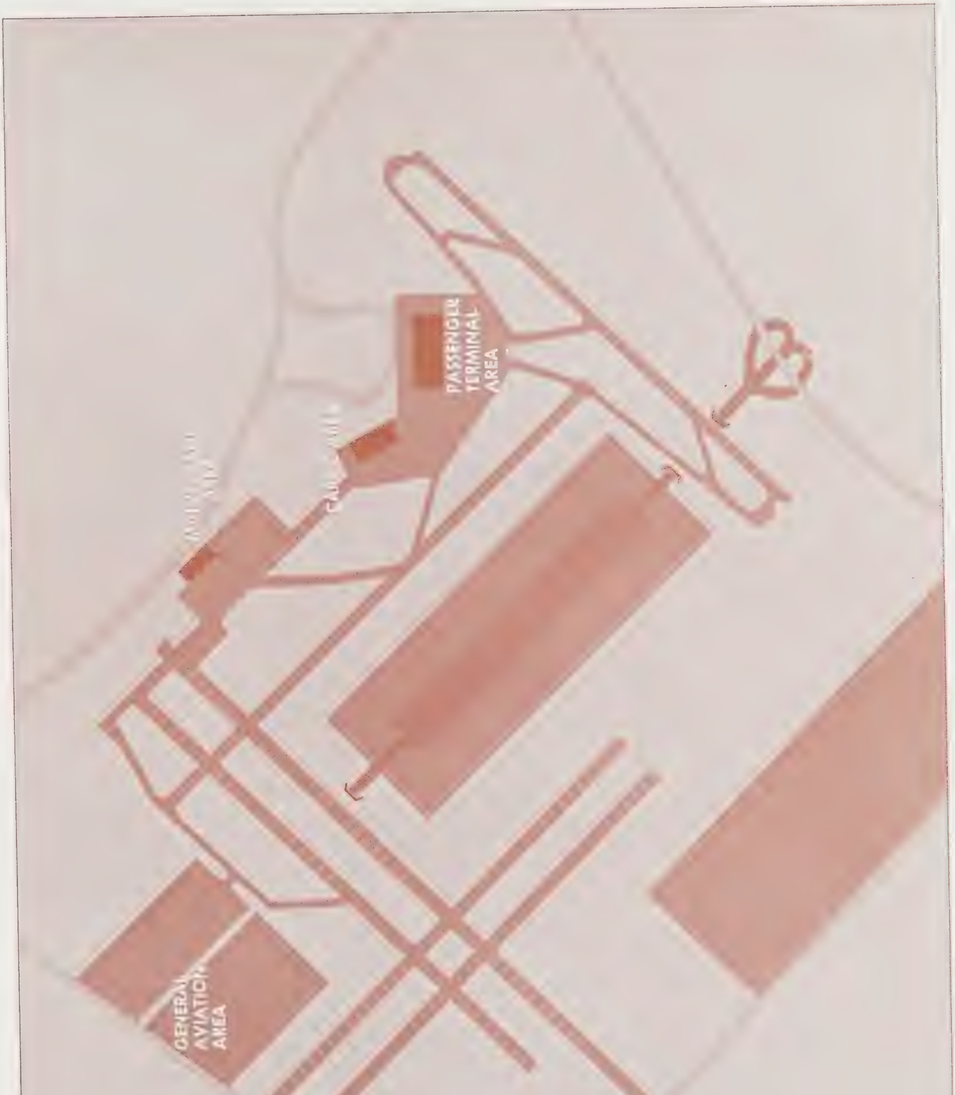

TERMINAL
AREA

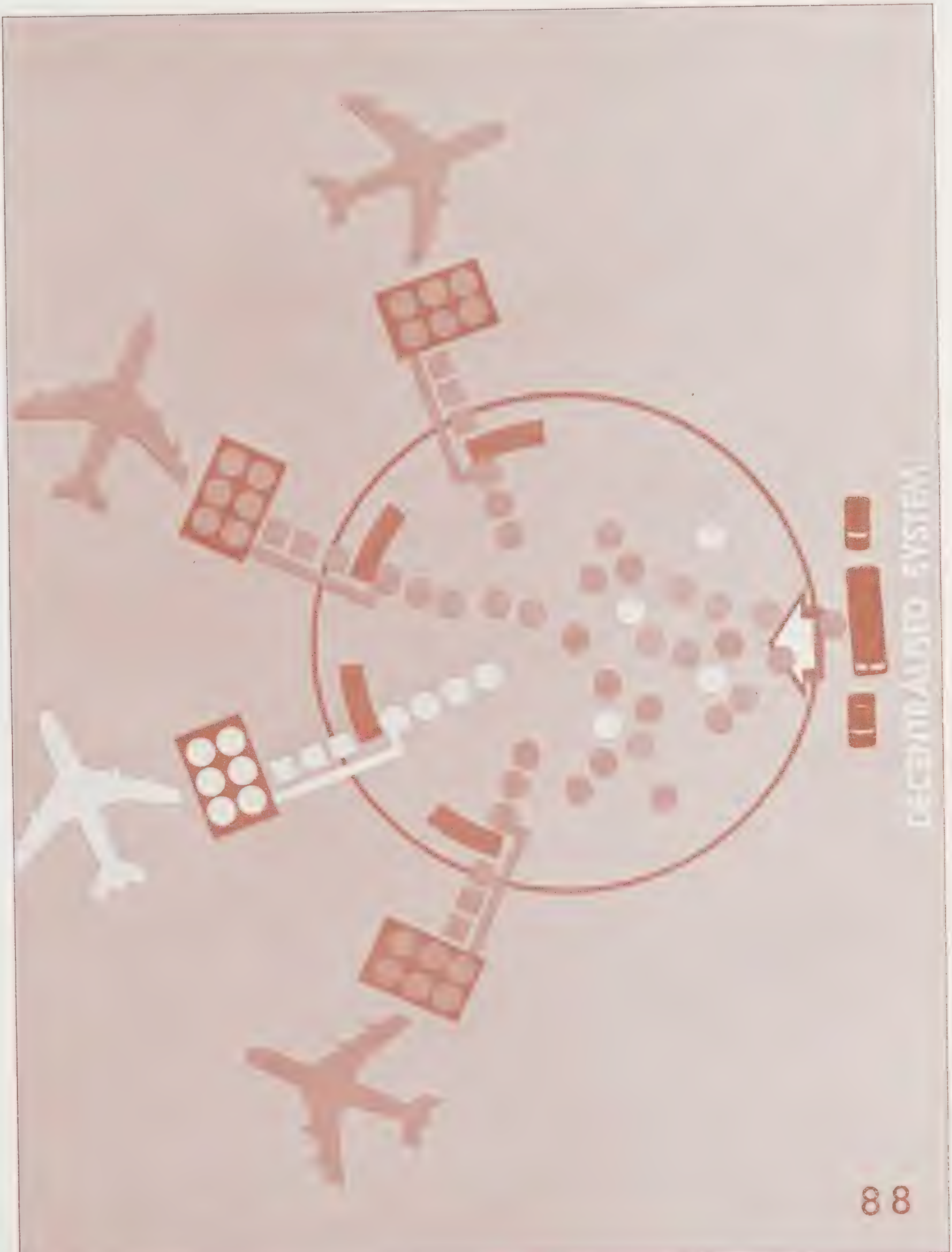

IFR/HR
120
100
80
60
40
20
0
20%
40%
60%
80%
100%
second 14/32
second 05/23
air carrier
second
air carrier
05/23
with
improved
equipment
present
runway
system
capacity


PASSENGER
TERMINAL
AREA
CARGO AREA


PASSENGER TERMINAL AREA


AREA
AVIATION
AREA


PASSENGER
TERMINAL
AREA
GENERAL
AVIATION
AREA



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GOVERNMENT OF CANADA

by

3a) N.J. PAPPAS AND ASSOCIATES, MONTREAL

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